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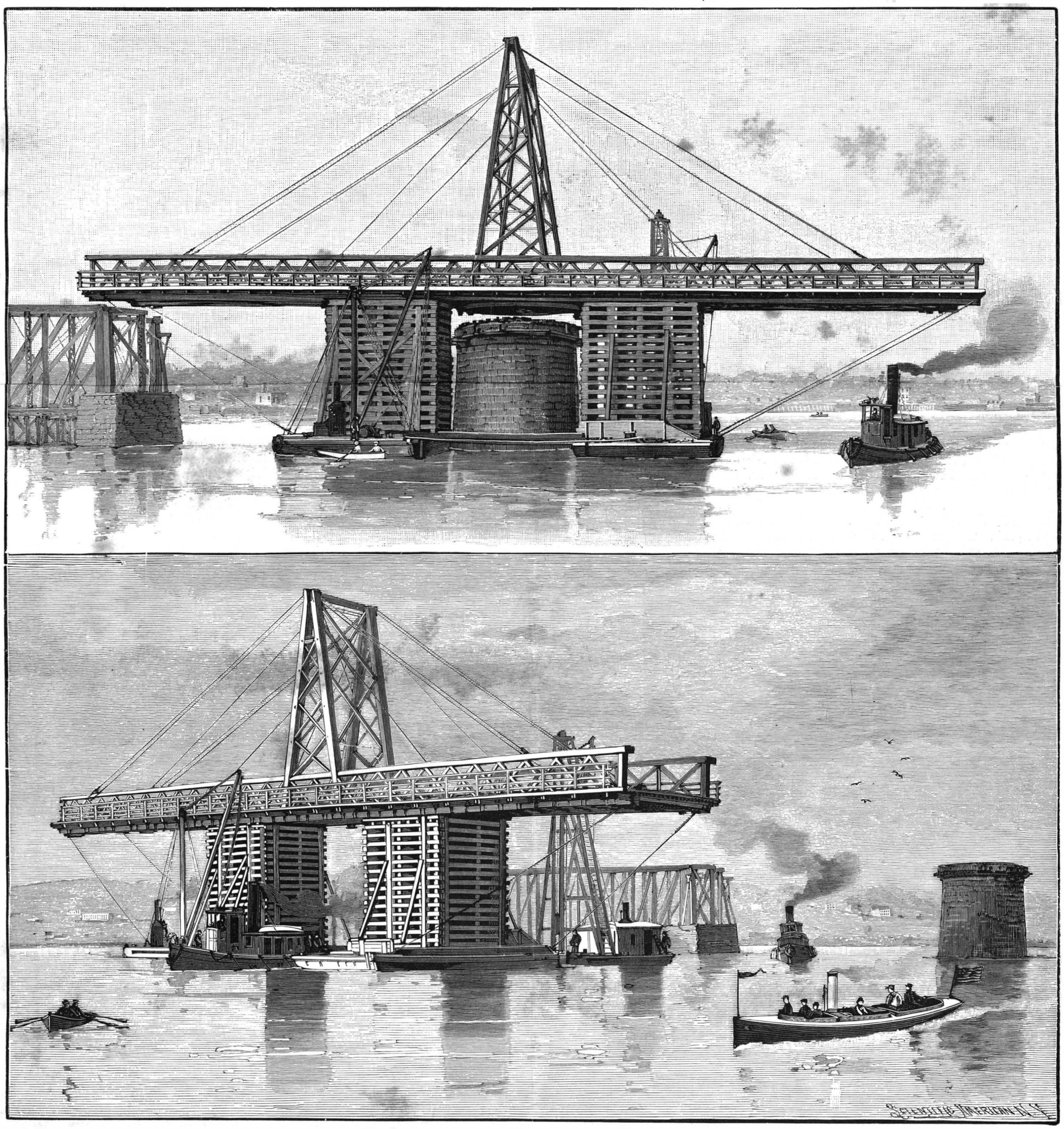
MOVING THE CENTRAL DRAW SPAN OF SEVENTH AVENUE BRIDGE.

The work in process of execution in the city of New York upon the banks of the Harlem River, on the northern parts of the island, has involved some very extensive engineering operations, several of which have been described in our columns. The 155th Street viaduct, starting from the high ground on that street, near 9th Avenue, at about the commencement of the new Speedway, has its eastern terminus on the banks of the Harlem River, near 7th Avenue. Here the river was formerly spanned by a wooden bridge with central swinging truss, the structure being known as McComb's Dam bridge. It was very familiar to the horsemen of the city, as being on the road to Jerome Park, a road much frequented by drivers of trotting horses, and a route lined with road houses, many of which were landmarks of years' standing.

In prosecuting the improvements in the neighborhood of the eastern end of the viaduct, the replacement of the old wooden bridge by a steel one was determined upon. The new bridge crosses the Harlem River, and by a long steel viaduct across the flat ground, on the northern shore of the river, connects with Jerome Avenue, the road leading northward from its terminus and the one mentioned above. It became necessary to remove the old wooden bridge and to build some substitute therefor while the new one was in process of erection. We illustrate one of the steps in this work.

The temporary bridge lying to the east of the old site had to be a drawbridge, and the draw span of the old McComb's Dam bridge was decided on to supply



Lifting the span by means of the tides. The span in transit to its final position

MOVING THE DRAW SPAN OF THE SEVENTH AVENUE BRIDGE, NEW YORK CITY.

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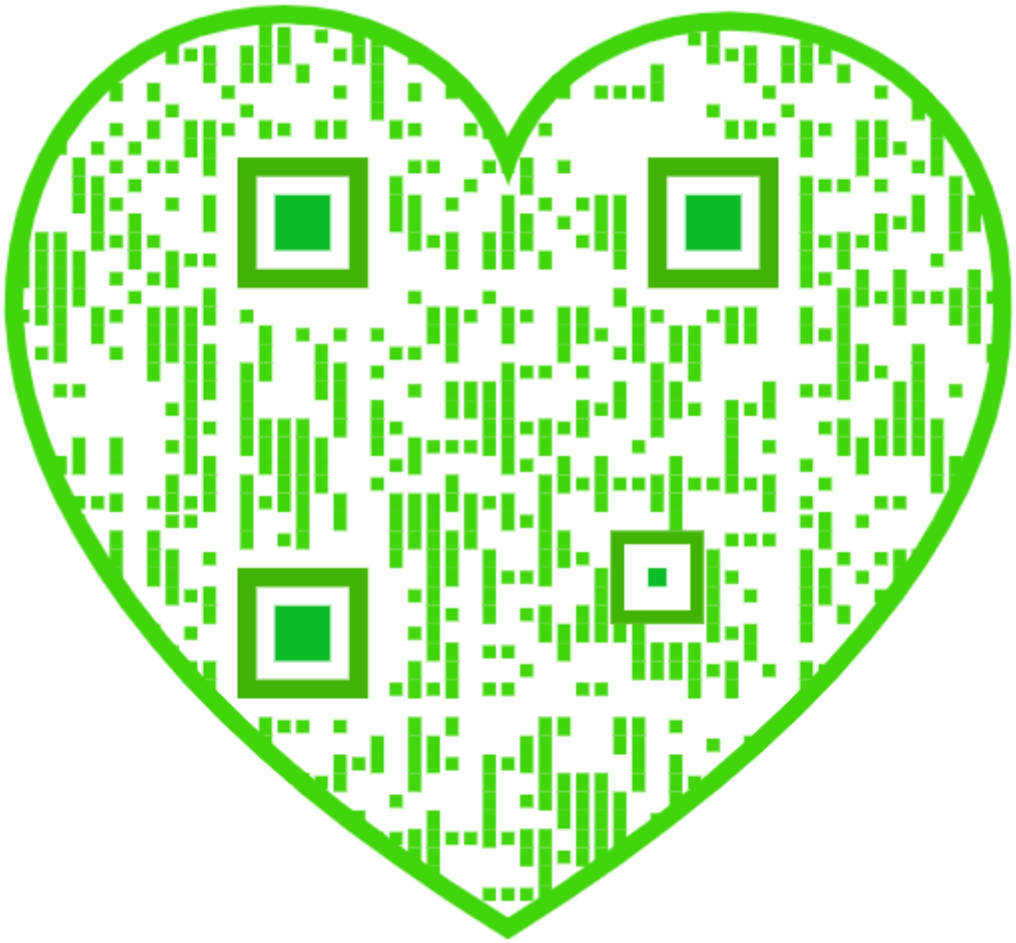

the draw span. This span was a wooden truss whose general construction is seen in our cuts. Its moving involved the lifting of it from its old central pier, its transfer to the site of the temporary bridge, followed by a lowering of about eight feet to conform to the grade of the rest of the bridge.

The fact that the Harlem River is a tidal stream was taken advantage of for the operations. Two seventy foot deck scows were moored, one on each side of the central pier. Two cross beams were provided for fastening the scows together, which beams were bolted to the deck. One was unbolted and drawn back as the scows were put in position, so as to make way for the central pier, which had to come between them while the free ends of the scows were temporarily secured by tackle.

Cribwork was now built up on the decks of the scows, Georgia pine timber twelve inches square in section being employed. As the tide fell the cribwork was carried up close under the bridge, and when the tide rose the scows rising with it lifted the truss bodily from the stone pier. Guy ropes were fastened to the ends of the truss and the scows were moved away with it, the cross timber being replaced as soon as there was room. The whole was then moved to the new position.

The span had now to be lowered about eight feet. The tides were utilized for this purpose. The scows brought the span over the site of the temporary center pier, which was built up with cribwork to approximately the level of the old pier. As the tide fell the truss rested on this. A few layers of blocking were removed from the top of the cribwork on the scows, so that as the tide rose the truss, while raised, was not lifted to its old level. Some of the timber was next removed from the pier, so that as the tide fell and the truss took its bearings on the pier it was lower than before. By repeating this process the draw span was eventually left in place and at the desired level.

The entire operation, executed by the firm of T. & A. Walsh, of this city, was carried out without any accident, and was completely successful.

Why Woman Ought Not to Work.

"The problem of woman from a bio-sociological point of view" is treated by Signor G. Ferrero in the current number of the *Monist*. "The essential condition of feminine existence," which he desires to analyze in his paper, is that which he names "the Law of *Non-Labor*." "As it is a natural law that the man must labor and struggle to live, so is it a natural law that the woman should neither labor nor struggle for her existence. Biology clearly shows us that the physiological prosperity of species depends on the division of labor between the sexes, for in exact ratio to this is the duration of life." Marriage, as found among the higher animals, is "a perfected form of the division of labor and mutual co-operation of the sexes." During hatching time the male bird does all the providing for his brooding mate. At other times her functions in seeking food are merely auxiliary. Similarly with lion and hyena. The fearful toil which falls to the savage woman the writer pronounces to be "merely a passing phase, a very dangerous aberration, produced by the excessive selfishness of man, which does not and cannot last long." He remarks that the races in which it is found "have remained in a savage state and have made scarcely any progress." In civilized nations female toil is not necessary for the production of the wealth needed for humanity. "Man alone could do this. Woman labor only tends to lower the marketable value of male labor; for, while woman is working in the factories, there are everywhere, and especially in Europe, crowds of men vainly seeking employment, to whom the cessation of work is an oft recurrent and terrible evil. This shows that, even from a sociological point of view, female labor is a pathological phenomenon.

"Statistics show us an increase of mortality among women and children in countries where industrial life has pressed mothers into its ranks. A perfect woman should be a *chef d'œuvre* of grace and refinement, and to this end she must be exempt from toil. . . . The working woman grows ugly and loses her feminine characteristics. . . . Womanly grace and the love which men bear a beautiful woman have perhaps been the origin of paternal love and of all the other sweet and tender feelings of which the male is capable. Grace is the æsthetic side of weakness. Woman, more than man, enjoys all the benefits of civilization, which nevertheless have been in great part acquired by him alone. . . . Man labors and toils to-day, just as he did of old, and there is nothing abnormal in this fact, for it is his positive duty. What advantage, then, can be gained by participating in man's struggle for existence, when woman has only to wait until he places these benefits at her feet? I cannot understand why the question of woman suffrage should so excite public opinion. It is entirely profitless to her. . . . If her husband strains every nerve already to provide her with all the luxuries of life, he will certainly not be lax in defending those interests which are identical with those of his family."

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AGAIN A TORPEDO BOAT SINKS A WAR SHIP.

The value of torpedo boats was again illustrated during the recent Brazilian revolt. Among the vessels seized by the insurgents was the ironclad war ship Aquidaban. After her escape from the harbor of Rio she went to Santa Catalina Bay, and here she was followed by the improvised fleet of the Brazilian government, consisting of the Nictheroy, one of the merchant steamers bought and armed in New York, and a few other boats of similar class, and a fast yacht formerly known as the Aurora, but supplied with torpedoes and newly christened Gustavo Sampaio. Three other small torpedo boats from Germany completed the attacking force. Having located the Aquidaban, the fleet approached in the dead of the night. A correspondent of the New York *Herald* says: The Sampaio ran up near the ironclad and received the fire of her small arms, but without serious damage. The Sampaio then discharged one torpedo, which missed the ship; then running up within a hundred feet of the ironclad, another torpedo was sent, which struck the great vessel on the port bow. The explosion was terrific. The bow of the big ship was lifted considerably, then with a quiver she settled down by the head in the water; but the ship did not sink. The crew of the Aquidaban, however, fled and made their escape in boats. The Brazilians boarded and took possession of the ship.

Her two forward compartments were found full of water up to the main deck. A topsail had been drawn over the hole in her bow by the crew; a diver was sent down to report on the damages. It was stated that a hole five meters by two meters existed between the first and second water tight divisions, that the steel framing and strapping were smashed, and the plates above the hole to the water line were badly cracked.

After two days' pumping work she was floated up high enough to allow her forefoot to rest in the mud. In this condition she will undergo temporary repairs to enable her to reach a dock at Rio. On her forecastle a 50-pounder Whitworth was mounted. Five Nordenfelt 1-pounders as a broadside battery were on her port side, together with a few 3-pounder Gardner field pieces of the same caliber and two Hotchkiss 3 pounder field guns on the starboard side. These, with her four 9·2-inch turret guns, comprised her armament.

Ammunition of all sorts and sizes was abundant, while cartridges for the small arms were not lacking. The hoist and shot cradles in the turrets were filled with projectiles, and fixed cartridges for the machine guns were in readiness to be served. The entire armament of the ship had been rendered worthless by the rebels. Breech bolts and blocks were missing, and the inside linings of the guns had been hacked with chisels, so that the guns are now utterly unfit for service.

The closing of the water tight doors must have prevented the entire hull being immersed, and the compartments exhibited their strength, having withstood the water pressure from two divisions. The after part of the ship was perfectly dry. The location of the guns on the Aquidaban was bad; that is to say, their position to efficiently meet attacks from torpedo boats was wrongly determined.

THE GREAT RAILROAD STRIKE.

The Inter-State Commerce Commission, organized by the Federal government for the purpose of studying railroad statistics, recently completed a report on the operations of the United States. It appears that there were 1,890 railroad corporations in the United States during the year ending June 30, 1893. They received in that period nearly a billion and a quarter of dollars. They carried 593,560,612 passengers over 14,229,101,084 miles and transported 745,119,482 tons of freight a distance of 93,588,111,833 miles. These operations were conducted on 176,461 miles of railroad. In round numbers 900,000 employes of all grades are supported by these roads, making one person in every ninety of the population of the United States. Accepting the stated capitalizations which the companies have reported, it appears that on an investment of $10,500,000,000 less than one per cent of dividends were paid. It is calculated that out of every dollar that was received by the railroad companies, 75 cents went to their employes.

It is self-evident that the railroad industry of the United States is an enormous one. The vast body of men who operate it are a power for good or evil. Every citizen has his interest affected by them. Perhaps the investor in railroad securities is as little affected as any one by their actions, but the suburban residents all over the country have their very home life at the mercy of the train which transports them to and from their business, the dweller in the extreme East finds the price of his meat raised by a railroad strike hundreds of miles away in Chicago or other center, and the merchant in the delivery of his goods is greatly impeded in his business by any irregularity of the running of trains.

The papers of the entire country have been full of the accounts of a great strike now in progress. It is conducted ostensibly by an organization termed the American Railway Union. It started originally in consequence of an announcement made by the Pull-

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man Car Company that they could not continue to run their works without a reduction of wages. This would seem to be a very small matter, but Pullman cars are run on roads all over the United States, and a boycott aimed at the Pullman Car Company took the form of a refusal on the part of the American Railway Union to permit its members to take a part in running any trains that were made up in whole or in part of Pullman-made cars. In this way, from a small beginning and from a cause involving a few hundred workmen, the strike has assumed large proportions and has finally become a contest between the United States government and the American Railway Union.

Several causes have brought about the Federal interference. Some of the affected railroads are in the hands of receivers appointed by the United States courts, and the operations of such roads are of course under the supervision of the United States government. The majority of the roads are engaged in interstate commerce, and practically all of them carry United States mail. This makes them objects of Federal intervention and protection. Accordingly, a representation of the small standing army of the United States has been summoned to the scene, and a number of regular soldiers have been dispatched to different places where the strike is at its worst.

Very peculiar features have been noted. In some cases, where the militia were ordered out, they have refused to act, evidently being in sympathy with the strikers. The United States troops in some cases were baffled by the acuteness of action and movement of the strikers, some of whom would uncouple cars protected by the troops, and would then disappear so quickly in the crowd that they could not be fired at. In another case, where some women uncoupled a train, their sex operated to prevent the regular soldiers from firing upon them.

The operations of the strikers have included derailment of trains and general interference with the operation of the roads. It is evident that a problem in practical politics of the most difficult kind is before the country. To define the action of the strikers as anarchistic, while doubtless etymologically correct, gives no clew to a remedy. The increasing interdependence of mankind brings more forcibly to the front every day the necessity of order in the social world. In the destruction of property the social economist recognizes the loss of all, not merely of the individual directly affected. Every strike in a railroad interferes directly or indirectly with the well-being of all the people of the United States. The seriousness of the problem cannot be overstated. Mr. Debs, the president of the railroad union, announces that the first shot fired by the regular soldiers at the mob will be the signal for a civil war. On the other hand, Mr. Debs himself is threatened by arrest and prosecution by the Federal authorities. It now remains to be seen whether the government is the real ruler of this country or whether the supreme power is wielded by the American Railway Union.

On the Mechanism of Electrical Conduction.

Prof. C. V. Burton, D.Sc., read a paper on April 27 before the Physical Society (London) on the "Mechanism of Electrical Conduction," the first part of which dealt with conduction in metals. The following brief abstract of his paper is clipped from the *Electrician:*

"Considering a body not at absolute zero of temperature, the author shows that electromagnetic radiation would result in heat being degraded into a lower form of energy, if any parts of finite electric conductivity were present, and from the fact that our planet is not devoid of heat, deduces the following Theorem I.: 'In a region containing matter, there may be (and probably always are) some parts which are perfect insulators and some parts which are perfect conductors, but there can be no parts whose conductivity is finite, unless every finitely conductive portion is inclosed by a perfectly conductive envelope.' This conclusion is in accordance with Poisson's theory of dielectrics and with Ampère's and Weber's theories of magnetism and diamagnetism respectively. Theorem II. is enunciated as follows: 'In metals and in non-electrolytes whose conductivity is finite, the transmission of currents must be effected by the intermediate contact of perfectly conductive particles;' and as a corollary Theorem III. is given: 'If we suppose that in a substance at the absolute zero of temperature there is no relative motion among the molecules or among their appreciable parts, it follows that every substance at this temperature must have either infinite specific resistance (which does not imply infinite dielectric strength) or infinite conductivity.'

"Fleming and Dewar's experiments on pure metals tend to confirm this. The author then shows why, on the intermittent contact hypothesis, a conductor is heated when a current flows through it. On the assumption that in ordinary conductors the relation between the electromotive intensity in the intermolecular spaces and electric displacement is a linear one, and that the electric forces are small in comparison with the ordinary intermolecular forces, Ohm's law is deduced. A model is next described, by means of which contact E. M. F. and the Peltier effect can be represented and explained, and in considering Volta E. M. F.'s, the author points out that it is doubtful whether experiments in a perfect vacuum could decide the questions at issue in the contact-force controversy. The fact that the transparency of metals is much greater than Maxwell's theory indicates might be explained without attributing any new properties to the electromagnetic field by supposing the dimensions of molecule not quite negligible in comparison with the wave length of light."

Nature's Most Invincible Creatures.

BY DR. EUGENE MURRAY AARON.

We are apt to consider ourselves the most powerful and all-conquering members of the animal world, and next to us we range such creatures as the lion, tiger, grizzly bear, and elephant, as capable of maintaining their own against all comers in an open hand-to-hand or mouth-to-mouth fight. Yet in doing so we err greatly, simply because we consider mere bigness or muscular force, forgetting the energy and the intellectual powers that make one of nature's tiny creatures, when combined in the vast numbers in which they are always found, by far the most formidable animal force known on land. Therefore, when the question is put to us, "Which do you consider the most resistless of all animals?" it is always safe to reply that if warlike manifestations are referred to, the soldier or driver ants are far and away the most terribly invincible creatures with which we can be brought in contact.

Monsieur Coillard, a French missionary in the Barotse Valley of South Central Africa, thus writes of these terrors there: "One sees them busy in innumerable battalions, ranked and disciplined, winding along like a broad black ribbon of watered silk. Whence come they? Where are they going? Nothing can stop them nor can any object change their route. If it is an inanimate object, they turn it aside and pass on; if it is living they assail it venomously, crowding one on top of the other to the attack, while the main army passes on, businesslike and silent. Is the obstacle a trench or a stream of water? Then they form themselves at its edge into a compact mass. Is this a deliberating assembly? Probably, for soon the mass stirs and moves on, crosses the trench or stream, continues in its incessant and mysterious march. A multitude of these soldiers are sacrificed for the common good, and these legions, which know not what it is to be beaten, pass over the corpses of these victims to their destination."

Against these tiny enemies no man, nor band of men, no lion or tiger, nor even a herd of elephants, can do anything but hurriedly get out of the way. Among the Barotse natives a favorite form of capital punishment is to coat the victim with grease and throw him before the advancing army of soldier ants. The quickness with which the poor wretch is dispatched is marvelous when it is considered that each ant can do nothing more than merely tear out a small particle of flesh and carry it off. Yet in a surprisingly short time the writhing victim will have been changed into a skeleton of clean and polished bones that will make the trained anatomist envious.

All are familiar with the tales of how these armies of ants enter a tropical village and take entire possession of it, driving its inhabitants out in terror, and at last in a few hours or a day or two abandoning it cleaner than the arts of the most orderly housekeeper could ever make it. These are not travelers' tales. The most gifted pen must fail to give an adequate idea to the uninitiated of just how thorough and searching these creatures are in ridding a house of every bit of animal or vegetable matter in it. Perhaps, however, the narration of the following bit of personal experience may help to illustrate it. I had returned from a day's tramp in the hills, laden with trophies in the shape of tropical insects, some of them, perhaps, new to the eyes of scientists, and all of certain value, when I was called out of my house by the cry, "The driver ants, the driver ants." Hastily placing most of my collections in glass jars and tin boxes, so as to be out of the reach of the invaders, and gathering such clothes as I would need for a day or two, I made a rather undignified retreat. After I had done so I remembered that I had left some rare bees pinned in a box that was in the pocket of my collecting coat, but as the coat had been placed in a strong chest and this chest was heavily scented with naphthalin or "tar camphor," and the lid fitted down very tight, I felt that they were safe. The next morning when I went back, after a night spent in my hammock in a tamarind tree, I found that of a bunch of bananas, consisting of a thick stem and about 100 of the fruit, there was no trace whatever, save the dangling string with which it had been hung from the ceiling; and not a vestige of bread, chocolate, coffee, and other eatable odds and ends could be found on the thoroughly cleaned shelves on which some food had been left. Even the cracks between the floor boards had been cleaned out, the particles of edible matter having been carried away or devoured and the mere dust left where it could easily be swept away.

This was not so bad, for a good cleaning never hurts a house in the tropics; but when I came to examine my chest and found that a hole quite two inches in diameter had been torn in one end through an inch board of hard wood, that the box in my coat pocket had also been pierced and every one of the pins on which my beetles had been arranged stood in place as empty and clean as when taken out of the paper, I had a better idea of the thoroughness of these tiny scavengers than ever before.

The Economy of Gas Engines.

In a paper read before the Incorporated Institution of Gas Engineers, at their recent meeting in London, Mr. Bryan Donkin gave a number of facts as to the extent to which gas engines are used, and the degree of economy they have attained. He said that, according to Mr. Dowson, gas engines for electric lighting, developing about 7,000 horse power, had been sold in England, and Otto engines for 11,000 horse power in Germany. Messrs. Crossley informed him that the number of Otto gas engines in use in England was about 20,000, and he might assume that there were about nearly double this number for all kinds of gas engines. At "Chateau Lay" an Otto gas engine, feeding about 650 glow lamps, consumed 1·2 pound of fuel per indicated horse power hour for the manufacture of its Dowson gas. At the Chelsea Flour Mill, a 60 nominal horse power twin cylinder gas motor with Dowson gas used during a full load test about 0·87 pound of anthracite and coke per indicated horse power per hour. The engine had a cylinder 17 inches in diameter by 2 feet stroke, and made 156 revolutions per minute. It had been at work about two years. At the Leven Tweed Mills there were, he said, four gas engines with Dowson gas, developing about 200 horse power. These engines used, during a six days' test, 1¼ pounds of anthracite per brake horse power per hour. With coke from the gas works the consumption was 1¾ pounds per hour. At Godalming Paper Mills there were gas engines giving 400 indicated horse power, with an average consumption of 1 pound of fuel per indicated horse power per hour. At a weaving mill in Halifax there were four gas engines of about 200 indicated horse power, using 1·4 pound of gas coke per horse power per hour. At the Uxbridge Water Works a water pumping test was made in February, 1892, using generator gas. The consumption was 1 pound of coal per indicated horse power, or 1¾ pounds per horse power of water lifted per hour. The approximate power was 16¾ indicated horse power. The whole of Messrs. Crossley Brothers' large works are driven by gas engines, using Dowson gas, made from anthracite coal. There are eight gas motors from 12 to 30 nominal horse power, indicating collectively about 325 horse power. The firm stated that the consumption was from 1 pound to 1¼ pounds per indicated horse power hour. The net cost to them of the anthracite fuel, labor, interest on capital, and repairs worked out at about 2½*d.* per thousand cubic feet. Comparing this with average town gas, and allowing for the difference in thermal value, the equivalent cost would be about 10*d.* per thousand cubic feet. A single cylinder gas motor, indicating 280 horse power, driving a large flour mill in France, was lately seen by Mr. Donkin working with generator gas from French coal. The preliminary trials gave about ¾ pound per indicated horse power per hour. The engine will give a maximum of 320 indicated horse power.

The Niagara Falls Power Company.

The supply canal leaves the Niagara River about 7,000 feet above the Falls. It is 188 feet wide and 12 feet deep, with cut stone walls. From this canal water passes by gates and penstocks to the turbines. At present the wheel pit is constructed only on the western side of the canal. This pit is 21 feet wide, 179 feet deep, and 150 feet long, and the turbines are now being placed in the northern end of it. The penstocks which supply the turbines are 7½ feet in diameter, and the turbines themselves, each of which is double, take the water at the center and discharge outwardly. These are 5 feet 3 inches in diameter, and each double turbine will develop 5,000 horse power. The shaft from the turbines is of hollow steel, 38 inches in diameter and ⅜ of an inch thick. At bearings, the shaft is solid and 11 inches in diameter. The turbines are so arranged that the weight of shafts, turbines, and gear is counterbalanced by the upward thrust of the water, so that when running the thrust will be on the bearings at the top. These are to run at 250 revolutions a minute. The breadth from the surface of the water in the canal to a point half way between the two double turbines is 136 feet. The tail race is a tunnel, 7,000 feet long, 21 feet high, 18 feet 10 inches wide, lined throughout with brick. It has a fall of 52½ feet, and opens at the bottom of the gorge, just below the upper Suspension Bridge, at the level of the stream.

THE largest European city park is in Denmark; it contains 4,200 acres.

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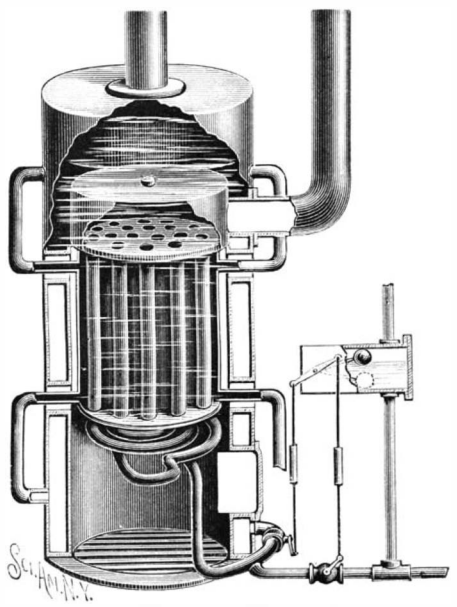
AN IMPROVED BOILER FOR HEATING PURPOSES.

This boiler combines to a certain extent the features of a tubular and a coil boiler, giving a very large heating surface, and is designed to promote rapid circulation while being operated with great economy of fuel. It has been patented by Mr. Albert Jaeger, of No. 105 Bleecker Street, Jersey City Heights, Jersey City, N. J. When the boiler is used to make steam, the compartment at the top forms the steam space. There are vertical flues through the central water space, and this portion of the boiler is encircled by a flue just below the smoke box, there being a fusible plug in the top of the latter, designed to melt when the water gets too low, and cause the putting out of the fire. The lower and upper portions of the shell have pipe connections with the tubular section, and a pipe from the lower part of the shell leads to a coil in the top of the



JAEGER'S STEAM OR HOT WATER BOILER.

firebox, the coil connecting by a vertical pipe with the top portion of the heater. The return pipe at the bottom is connected with a vertical pipe leading to a tank, and the latter is connected with the main steam pipe, to enable the steam from the boiler to balance the water pressure of the return flow. The tank is set at the desired height, and back of the boiler connection is a valve, there being another valve in one of the lower circulating pipes of the heater, each of these valves being connected by a rod with a tilting lever on a shaft extending through the tank, so that when one valve is open the other is closed. The arrangement is such that an active circulation is kept up, water enough being constantly drawn into the coil to prevent it from being burned, while there is at no part of the boiler a great bulk of water, the water being so distributed as to be exposed to a great heating surface.

A COMBINED CAMERA AND GRAPHOSCOPE.

The accompanying illustration represents a recently brought out little device, called the "Kombi," adapted for use as a picture exhibitor as well as a camera. It is 1⅝ inches square and 2 inches long, our engraving

showing the detachable rear part opened to exhibit the roll holder and with the time exposure cap and rear cap removed. The negatives are taken on a strip of sensitized film, each strip capable of receiving twenty-five negatives. When a strip of film is filled, the negatives may be printed on a transparent strip and placed in the roll holder, where the strip of sensitized film had previously been, and the device is then ready for use as a graphoscope, or picture exhibitor, the pictures upon the transparent strip, when viewed through the lens, being magnified and coming out more clear and perfect. The pictures taken may be 1⅛ inches square or 1⅛ inches in diameter, the small views showing reproductions of two picture portraits taken in this way, landscape and other pictures being similarly taken. The instrument is arranged either for instantaneous or time exposures. It is made of seamless metal, with a finely oxidized silver finish, and weighs when loaded for twenty-five exposures only about four ounces. It is neat, compact, simple and very inexpensive for the work it may be made to do. It is manufactured by Mr. Alfred C. Kemper, Nos. 208 and 210 Lake Street, Chicago.

A COMBINED CAMERA AND GRAPHOSCOPE.

Sense of Smell in the Seal.

"Among the many singular traits of character possessed by seals," said Oliver L. Mason, a retired sea captain, to a reporter of the St. Louis *Globe-Democrat*, "none are more striking than the devotion of the male to its offspring, contrasted with the apathetic attention paid by the mother. The latter will at the least alarm bolt away into the sea and leave her babies behind her, but the bulls mount guard over the swarming herds of young, and nothing can exceed their devotion and courage when called upon as protectors. The sense of smell possessed by the seals is very strong, and will invariably wake them out of a sound sleep, even if you come upon them ever so quietly to the windward, and you will alarm them in this way much more thoroughly, though you be half a mile distant, than if you came up carelessly from the leeward and even walked in among them, they seeming to feel that you are not different from one of their own species until they smell you. The chief attraction in these animals is their large, handsome eyes, which indicate great intelligence. They are a deep bluish black, with a soft glistening appearance, and the pupil, like the cat's, is capable of great dilation and contraction."

The Kitchens of Parisian Restaurants.

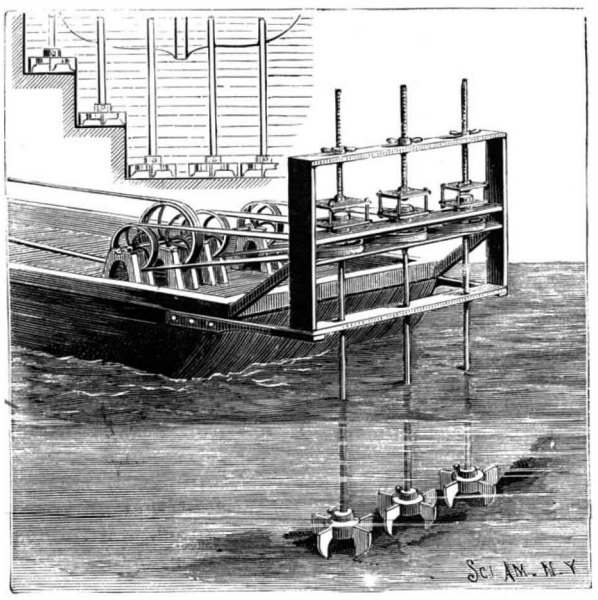
Parisians, as well as foreigners, who take their meals in the sumptuous and more or less gilded restaurants of Paris seldom give a thought either to the places in which are prepared the dishes served or to the professional maladies of most of those who prepare these dishes. A study of the kitchens and cooks of Paris is interesting, because there are more than 3,500 of the latter, because they constitute a corporation and are divided into mutual aid societies. Of very limited dimensions, the kitchens of the great restaurants of Paris are, as a general thing, situated below the sewers, without air, without light, except what can be got from glass lights or openings in the pavement. The gas is burning there constantly, and causes a heat which, added to that of the fires, makes these cellars a veritable place of torture, in which thousands of workmen, dripping with sweat, pass the greater part of the day in preparing the dishes which are afterward served to us. Examination shows that there are no places where more maladies exist than in Parisian kitchens.

Two respectable physicians who attend to the medical service of the Mutual Aid Society of the Corporation of Cooks of Paris ought to know something about the matter, and, in order not to be taxed with exaggeration on this subject, we cannot do better than give the testimony of these medical men. The cooks of Paris, say these gentlemen, and not only those of Paris, but also those of large cities—for the hygienic conditions under which these cooks work are everywhere the same—generally suffer from alcoholism, anæmia, rheumatism, liver complaint, pulmonary tuberculosis; besides nearly all of them have varicose veins, hernia, ulcers, and affections of the skin. These infirmities are so frequent that it has been necessary to change the rules for admission to the society, those having the maladies named having been formally refused admission. The need of being constantly on their feet, as well as the heat of the fires, softens the tissues and dilates the veins. In order to endure what they have to undergo and to quench the thirst which consumes them, the cooks are obliged to drink, and, as barley water or water mixed with wine or coffee does not strengthen them sufficiently, and as, moreover, the stomach is disordered by emanations from the gas and coal, they take alcoholic drinks, vermouth, absinthe and an endless series of bitters. Once started on this road, the cooks become either alcoholic or dyspeptic; the liver is attacked, vomiting and chronic diarrhœa are frequent. The sudden variations of temperature to which these men of from twenty-five to thirty years are exposed on quitting the range to go outdoors or to the refrigerators predisposes them to rheumatism and phthisis. Finally we allude to the burns, the whitlows, the chaps and ulcerations of the hands, which are customary with dish washers and pot cleaners, to point out that such affections are very difficult to cure.

The lesson to be drawn from these undeniable facts seems to us very clear, and it is a lesson which every one who eats at restaurants would do well, if only for his own sake, to heed. With airy kitchens, well ventilated, well lighted, not situated in unwholesome underground places, it would not perhaps be possible to do away with all the professional maladies which attack this interesting class of working people; but you would avoid at least a portion of these maladies, those which are contagious for the customers of the restaurants—tuberculosis and eczema. The personal interest of consumers, who as a usual thing see nought but the gilded dining room, the comfort which the keepers of them, dressed in the canonical black suit, provide, ought to make it worth while to take some trouble to aid in changing the deplorable hygienic conditions under which the dishes served are prepared.—*Journal des Economistes.*

AN EXCAVATOR FOR USE IN HARBORS, RIVERS, ETC.

For deepening and improving waterways and channels, removing sandbars, etc., where there is a considerable action of the tide, or where the currents are appreciable, Mr. George P. Anderton, of Concession, La., has invented and patented the excavator shown in the illustration, the small view showing the cutters arranged for forming a slope. In a suitable framework projecting from the bow of a dredging scow are arranged vertical shafts, each carrying a cutter at its lower end, and on each shaft a pulley is keyed in a keyway, to permit of raising and lowering the shaft without disconnecting it from the pulley, all the pulleys being connected with pulleys on a main driving shaft actuated from an engine on the vessel. To raise and lower the shafts, the upper end of each shaft is engaged by a plate connected by bolts with a second plate, and the latter plate is engaged by a screw rod extending up through a top plate of the framework, there being on the upper end of this screw rod a handled nut, by turning which either shaft will be raised or lowered. The revolving cutters cut up the material and churn and stir it so that it will be carried away by the current or tide as the vessel moves forward, any desired number of cutters being employed, and the frame being arranged accordingly.



ANDERTON'S EXCAVATOR.

Fire at an Italian Match Factory.

A serious fire occurred recently at the Tedeschi match factory in Naples. It was caused by two of the employes, who had a dispute which ended by their pelting each other with boxes of matches. The matches became ignited and set the whole building on fire. A panic prevailed among the workpeople, who were mostly women, and a large number threw themselves from the lower windows. Several were injured. The fire was not got under control until after five hours exertion on the part of the brigade, whose efforts were ably seconded by the troops summoned to the scene.

Wild Camels in Arizona.

A. W. R., of Genoa, Nevada, thinks the wild camels of Arizona are descendants of a herd of camels brought to Nevada between 1864 and 1870 for packing salt over a dry and desert route to the quartz mills at and near Virginia City. They were used in that way for a time, but proved unprofitable. They proved a nuisance and were turned loose, and a law was passed prohibiting them from running at large on or about the highways. They were taken to Arizona, where it is supposed they remained.

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THE DOWE BULLET PROOF CUIRASS.

So much has been written about the Dowe protective cuirass, that our illustration of a test made of the invention at a London music hall, "The Alhambra," will be interesting. It also points a moral in showing an invention in the art of war applied to the art of amusement.

Herr Dowe is a tailor of Mannheim, Germany. For a year and a half, he says, he worked on his invention, looking after his business during the day time. During his dinner time he would test his material in the shooting park. His wife was meanwhile lying ill, and just before he completed his invention she died, thus giving a touch of pathos to the inventor's story of his work.

The sample of the cuirass exhibited in London is in appearance a block of felt two or three inches thick and about eighteen inches square. The construction is a secret, Herr Dowe keeping the cuirass under lock and seal, except when in his own hands. For two years Herr Dowe has contracted with his manager, Captain Martin, to exhibit his invention, and our illustrations show the two men as they have been appearing in London.

Herr Dowe and the Cuirass.

Capt. Martin.

THE DOWE BULLET PROOF CUIRASS.

As exhibited, a rifle ball is first fired through a block of oak. Then the cuirass is hung upon a horse and is fired at without disturbing the animal in any way. Next the inventor puts on the cuirass, as shown in the cut, and his manager, Captain Martin, fires a bullet from a short distance, without affecting the inventor. As a final test, the cuirass is placed over a sheet of glass and arrests a bullet, the glass not being injured.

The Dowe cuirass will weigh, it is thought, eight pounds. But it is easy to see that it might have an extended application in war in the construction of gun shields and in the protection of cavalry. It seems incredible that the material described should succeed in stopping the bullet of such a piece as the United States Navy rifle, which has nearly penetrated forty-two inches of dry oak, and in another trial has gone completely through sixty-two one inch pine boards superimposed. In any case Herr Dowe shows the possession of great nerve and of a very full measure of the courage of his convictions in acting the living target for the exhibition of his invention.

As a species of burlesque comment on the Dowe invention, Hiram S. Maxim, of London, announced himself as also the inventor of a cuirass. His proposition, however, was taken in dead earnest. The story is amusing. He claimed that he had something better and lighter than the Dowe shield, stated that it was made of organic and inorganic material, offered to sell the secret for 7*s.* 6*d.*, and announced an exhibition. The thing was taken seriously by the public. A great crowd assembled, whereupon it transpired that Mr. Maxim's exhibition took largely the aspect of a practical joke, and his shield proved to be a plate of nickel steel, the carbon being the "organic material." Mr. Maxim himself says that he had no idea that his 7*s.* 6*d.* offer would be taken so seriously. He says that some hundred of the visitors, headed by a very pompous officer, left indignantly ("in a great huff," Mr. Maxim put it) when they found that his cuirass was only a "steel plate in a bag." It was subjected to fire, and, though weighing but 7 pounds to the square foot, resisted modern ammunition. Mr. Maxim, however, did not put the armor on his own person to be fired at, so Herr Dowe still leads him. The Maxim exhibition really went to show what good gun shields can be made of nickel steel. The English papers seem very indignant at Mr. Maxim's action. His own account indicates that he did not credit the full claims made for the Dowe cuirass, and that his exhibition was intended to be to some extent a criticism thereon.

Later on he produced his plate of steel at the Westminster Aquarium, where it was exhibited. It was marked with the word "Maxim" down its center, indicating the bullet proof area. This was fired at, but the bullets failed to penetrate. Outside the limits of the name it was penetrable. Mr. Maxim, on being invited to stand behind his cuirass, declined to do so. While ready and apparently anxious to cast cold water upon Herr Dowe's invention, he would not act as a similar exponent of the merits of his own steel armor.

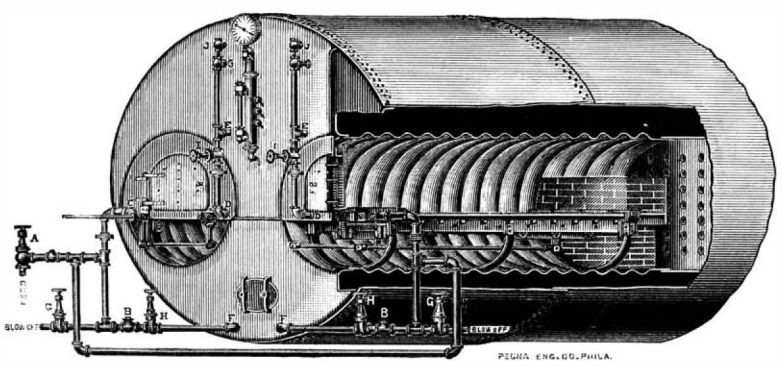
At another of the London halls a team of rifle experts have been exhibiting a bullet proof dress worn by a woman, one of their number. This marks the third music hall exhibition of defensive armor, and at least indicates that we may require armor-piercing projectiles for small arms as well as for the great rifles. A cuirass has also been reported from Hungary, invented by an officer of the Austrian army, named Sylander, so there seems to be abundant choice of material.

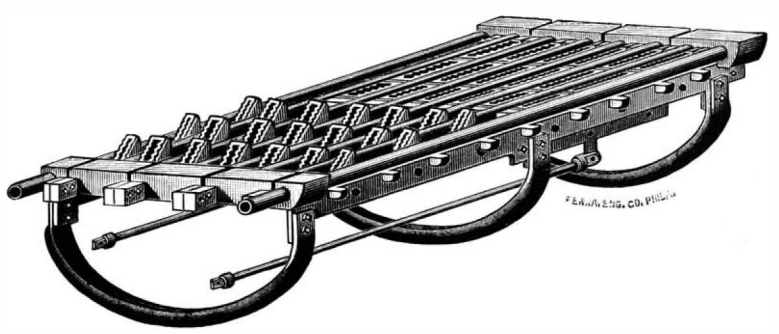
THE REAGAN MARINE WATER CIRCULATING AND SHAKING GRATE.

The accompanying cuts represent the marine grate manufactured by Water Circulating Grate Company, 1028 Filbert Street, Philadelphia, and show grate before it is put in and after it is connected. With this grate a marine boiler can be kept at the same temperature both at the bottom and top and is equalized throughout. One hundred pounds of pressure or more can be obtained in from fifty to sixty minutes, as the circulation carries the water from the bottom of the boiler and returns it at the top, whether feeding or not. The circulation will break and rot out the scale, no matter how hard it may be. This grate should outlast a boiler, because the shaking device, being underneath the water bars, cannot be readily burned out or warped, as it is protected by the water in the bars and is unique in this respect. The fires can be kept low and bright at all times, and owing to this the combustion is quite perfect, and fires can be kept at a white heat.

With bituminous coal, fires need not be cleaned for weeks, except by shaking, as all parts of the fire can be cleaned with the least motion of shakers. The shaking device is in two parts, one half being in front and the other half at the back, and each can be operated independently of the other. All the water is fed through the grate into the boiler, and by this means, when the water enters it, it is at the same temperature as the water already in the boiler, thereby keeping the boilers equalized at all times. The connections are made so that the grates and boilers are blown simultaneously, keeping both grate and boiler free from sediment and scale. It is said that with this grate the work of three boilers can be done with only two, and save coal besides. The average increase of power which they give is claimed to be about 33 per cent. This grate makes steam very fast and holds it steady. The gain in temperature when feeding is from 110 to 130 degrees Fah., and the higher the pressure, the better the results. Marine boilers equipped with this grate will always have an equal expansion, which is a great point and worthy of consideration, especially with marine boilers.

Users of this grate claim a saving of 20 to 30 per cent in fuel and a large gain in power; inferior coal and coke, screenings, sawdust and shavings, show big results. In cases where coke and bituminous coal are used, there is no necessity of ever cleaning the fires at all. All parts of this grate are interchangeable, and can be taken from or put together without removing the grate or blowing the boiler down. When the grate is adapted to marine boilers, all the work on the grate is done before it is put into the furnace, and when finished is pushed in whole and in one solid piece; it is then dropped into its position. All grates are made to conform in size to the furnaces, and no alterations are necessary, all the feeds and blowoffs being left just as found; in other words, nothing need be altered or deranged. A pump or injector can be used, and hot or cold water can be fed as desired.





THE REAGAN MARINE WATER CIRCULATING AND SHAKING GRATE.

A large number of these grates have been in use for some time, and show little sign of deterioration. Moreover, this invention is no longer in its experimental stage, but, on the contrary, has long since been proved to the satisfaction of users to be reliable as a fuel-economizing and labor-saving device.

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Correspondence.

Coal Ashes for Peach Trees.

To the Editor of the Scientific American:

You are in error in saying that coal ashes have no value as a fertilizer. Some years since I had a peach tree about to depart this life. The leaves curled up. I placed one-half bushel of fresh coal ashes around the root; in three weeks a new set of leaves came out, and the following year I plucked over one bushel of fine peaches.

I can name you many of my friends who tried the experiment on their pear trees, and the result was a good crop the second year. The first year grew new wood and the next lots of fruit. The trees had not produced for several years before.

I will guarantee to any gardener if he will place from one to two bushels in the fall around his fruit trees, any kind, or grapevines, if he wishes, that the second year he will be well rewarded. I am always the farmer's friend. I have taken your valuable paper many years.

Philadelphia, Pa. W. R. HOWELL.

[The ashes cannot act as a direct fertilizer, but only by lightening the soil and, possibly, by making the fertilizing elements already present more available.—ED.]

The Blue Jay as a Nut Cracker.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of June 16, 1894, a correspondent describes the feat of a blue jay in killing and eating a snake. In western Oregon the blue jay varies his summer diet with hazel nuts. The only nut native to Oregon (so far as I know) is known as a hazel nut, and is a little smaller than a filbert, which it very much resembles. It ripens in July.

The bird carries the nut to a log or fence post and first strips off the outer husk. Then, getting a firm hold on it with his feet, he hammers away with his bill until he either cracks the shell or cuts a hole large enough to extract the kernel. I never discovered which. It is no mean trick in either case, as the shell is very hard and requires quite a blow to crush it. Few persons to whom I have mentioned this have ever seen it done, but it may be observed by any one who will go into the brush where blue jays and hazel nuts are plentiful when the nuts are ripening and listen for the sounds. My attention was first called to it by a small boy who avers that the bird has been heard to swear during the operation, the blue rogue having missed the nut and struck his foot. Be this as it may, I can vouch for the facts above set forth, having often been an uninvited spectator at such feasts.

Nelson, B. C., June 25, 1894. D. G. EALON.

The Black Calla.

To the Editor of the Scientific American:

In reply to your correspondent's query in SCIENTIFIC AMERICAN of June 16, in regard to the black calla, permit me to say that there are several plants popularly known as "black callas," all of which belong to the genus *Arum*, consequently are sisters of our native Jack in the pulpit, and cousins of the true calla, which belongs to the genus *Richardia*.

From the brief description given by your correspondent, I infer that the plant in question is *Arum dracunculus*. This species is conspicuous for its much divided foliage and exceedingly spotted stem. The bud, or properly the spathe, is light green without. As it shows not the slightest trace of color until it commences to expand, one who has never seen it before begins to grow suspicious that he has been humbugged—that it is not black at all. But when a glimpse at the interior is permitted, this skepticism is replaced by wonder and admiration. The open flower measures fully a foot in length, and the entire inner surface is like rich, reddish-black satin. The spadix, which extends to the very tip of the spathe, is even darker in shade, of a leathery texture, and hollow. The staminate flowers are clustered above the pistillate ones at its base. The single specimen that it has been my privilege to behold exhaled so obnoxious an odor on the day it opened that it became necessary to banish it from the house. When removed to the porch, it was almost immediately the center of attraction for numerous flies, which were doubtless lured by its carrion-like odor. And is it not possible that this fact shows an economic value in the single disagreeable quality of the plant? To those familiar with the various devices of the tropical orchids for enticing insects to assist in their fertilization, it is at least suggestive that in this case the process may be facilitated by the insect visitors. This theory is strengthened by the fact that after the first day the odor gradually diminishes, and in a day or so more is not perceptible in a closed room, unless one comes into close proximity to the plant; and even then it is not powerful enough to prove displeasing. If the theory that its purpose is to attract insects be true, the plant is doubtless in the best order to receive fertilization at the time of expansion; consequently only needs the perfume-bait at this time. In pressing it for the herbarium, as it was about to fade, I observed that the remaining traces of the odor all seemed concentrated in the hollow spadix, and it is likely that the spathe was from the first odorless.

Arum crinitum also has divided leaves. Its flower is about a foot in length, broader than the above mentioned, and with a shorter spadix. Its color is a deep black, and it makes an attractive pot plant, as it is almost sure to bloom in mid-winter.

According to florists, it is to *Arum sanctum* that the name "black calla" rightfully belongs. It is a native of the Holy Land, and is known as Solomon's lily. The leaf somewhat resembles that of the common calla. The flowers often measure more than a foot in length and from five to eight inches in width. Like those of *A. dracunculus*, the outside is green, the interior of the richest velvety purplish-black. The central spadix rises to a height of from 10 to 12 inches, and is of the deepest black. It is really the handsomest of the trio, and possesses not a slight additional recommendation in its favor by its fine fruity fragrance. It, too, is strictly a winter bloomer. After blooming, the foliage will die down and the bulb should be kept dry until re-planted in autumn. It is rapidly growing in favor, and is destined soon to become one of our most popular plants for winter blooming.

BESSIE L. PUTNAM.

The U. S. Coast Defenses.

At the recent convention af the American Society of Civil Engineers, Niagara Falls, the president, Colonel Wm. P. Craighill, U. S. A., delivered an interesting address on "Our National Defenses." He said:

When the civil war came on, our sea coast defenses were admitted to be as good as any in the world. In one great particular they were better than those of any other people—that was the Totten embrasure. In a casemated battery built for the defense of a great European port just before the introduction of the Totten embrasure here, the opening in the wall of the embrasure was 54 square feet, and the horizontal traverse of the gun was only 40 degrees. The Totten embrasure gave an opening of only 9 square feet, and gave a horizontal traverse of 60 degrees. The wall around the throat of this embrasure was strengthened by wrought iron a foot thick, inserted in the masonry, and lead concrete was also used as a most excellent material for resisting the impact of shot. Wrought iron shutters were added, which closed automatically, were thick enough to exclude grape shot, and kept out the smoke of the discharge. This invention of General Totten, who was then Chief of Engineers of the Army, is of historic interest as the first instance of the use of iron plating on land batteries. Some of these old forts are still of value, but not to be entirely depended upon for the defense of our harbors.

A very important part of our present system of defense consists of torpedoes, but these must be under the fire of guns on land, in order that the enemy cannot remove or disable them. The light craft which would be used by a fleet for this purpose would be vulnerable to the fire of such guns as will still be accommodated in the Totten embrasure. Great ironclads must be met by the heaviest guns and mortars, mounted behind impenetrable, covered masses, and made as safe as possible by all the modern improvements, but it would be a waste of energy and money to fight the smaller craft with these largest guns.

Some historical incidents were introduced to show the value of small guns, to be used at comparatively short range, and to show the defensive power of forts of even moderate strength. The attack of the British on Baltimore in 1812, and the experiences of Fort Sumter during our war, were introduced for this purpose. Invulnerability is not to be aimed at in constructing land defenses, but relative vulnerability and endurance, and here the advantage will always be on the side of the defense; and guns of a given power can be mounted cheaper on land than on water, and will have the advantage in stability and accuracy of fire.

No armor has yet been produced that can properly be called invulnerable, and it is safe to say that none such ever will be produced; and, unless the decks of ships are as heavily plated as their sides, they will be penetrable by shells from rifled mortars, the accuracy of which has recently been greatly improved.

It is often said, and especially by people in the interior, who themselves are not directly subject to attack, that no enemy would undertake to land an army on our shores, as our militia would rise and drive the invaders into the ocean. It is true that our people are brave, and, under discipline and with experience, make as good soldiers as any in the world; but in attempting to prevent a descent upon the coast they could make no prolonged resistance to the big guns of an invading fleet. The more the men who lined the shores, even with the best rifles and field artillery, the greater would be the slaughter. Some fixed defenses must be provided for our great cities and harbors. Reliance upon torpedoes alone is mistaken, for torpedoes may be taken up as easily as they can be put down, unless they are placed under fire from the shore—that is, they are only an adjunct to defense. Neither is it the best economy to mount our guns for harbor defense solely upon ships. This would require at every point to be defended a fleet as strong as the enemy could be expected to bring against it, and the first cost of mounting guns ashore is far less than putting them on ships, and the life of shore fortifications is longer than the life of ships. It would take a navy greater than that of all the other nations of the world combined to defend the immense coast line of the United States.

In 1816 the Board of Engineers laid down the following principles for the defense of our coast:

1. They must close all important harbors against an enemy, and secure them to our military and commercial marine.

2. They must deprive an enemy of all strong positions, where, protected by naval superiority, he might fix permanent quarters in our territory, maintain himself during the war, and keep the whole frontier in perpetual alarm.

3. They must cover the great cities from attack.

4. They must prevent, as far as practicable, the great avenues of interior navigation from being blockaded at their entrance into the ocean.

5. They must cover the coastwise and interior navigation, by closing the harbors and the several inlets from the sea which intersect the lines of communication, and thereby further aid the navy in protecting the navigation of the country.

6. They must protect the great naval establishments.

These principles are fundamental, and have stood the test of argument and experience, but the means of carrying the principles out have changed, and now it is necessary to concentrate at the points to be defended armaments equal in weight and metal to those of any possible attacking fleet, supplemented by torpedo defense.

Another important element in our defensive system is the ship canal, and an interior line of waterway, parallel to the Atlantic and Gulf coasts, is of great importance. It would be useful in peace, and in time of war its advantage to our naval and merchant marine would be incalculable. For instance, a ship canal connecting the great bays of the Chesapeake and the Delaware would enable a single fleet to be prepared to promptly meet an enemy threatening either of these waters. A great canal should connect the lakes with the Mississippi, and the Erie Canal should be made wider and deeper; but most important of all is a canal across the Isthmus, between the Atlantic and Pacific coasts. The immense commercial and military advantages to be gained from the building of such a canal should be controlled by the United States, and it is certain that the Nicaragua Canal will be opened before many years have passed, if not by the United States, by England or by Germany.

The Plague in China.

A correspondent of the London *Times* writes: "When the last mail left China a fearful epidemic was raging in Canton, and it appears to have been of a somewhat mysterious character. It is said to have been first observed in that city in the last week of March, and by the end of April had spread everywhere. It was marked by a sudden attack of fever, the temperature rising to 105°, or even higher, with headache, thirst and stupor. In from 12 to 24 hours after the first attack, a glandular swelling, hard and tender to the touch, appeared in the neck, armpit, or groin. Coma supervened, and death occurred in 48 hours. Sometimes blood vomiting took place, or spots appeared on the body, but there was no general characteristic eruption. At first the epidemic was limited to one or two quarters of the city, but it was very fatal, and it is said by the native doctors that two out of every three attacked died. It did not appear to be contagious, and it is said to be the 'bubonic plague,' described by travelers in western China. As a rule, the lower animals were also affected, thousands of rats especially being found dead at the commencement of the epidemic."

The special correspondent of the *British Medical Journal* telegraphs from Hong-Kong: "While regretting to have to confirm the announcement of an epidemic outbreak of the Oriental plague in this settlement, I am glad to be able to give the latest information, which is of a somewhat reassuring character. The plague commenced here on May 5; it presents all the symptoms of the true bubonic pest which ravaged Europe in the middle ages, and produced the terrible ravages described by Defoe during the great plague in London. This bubonic pest, although extinct in Europe, has never ceased to ravage China from time to time, and has also spread from there to Persia and Asiatic Russia. The symptoms here are of the classic type, characterized by the intense symptoms corresponding to those of typhus, and by the bubonic boils characteristic of the disease. I am glad to say that the Europeans here are unaffected, except in the case of ten of the military employed by the authorities in carrying out disinfecting work in the native quarter where the plague is located; one of them is unhappily dead."

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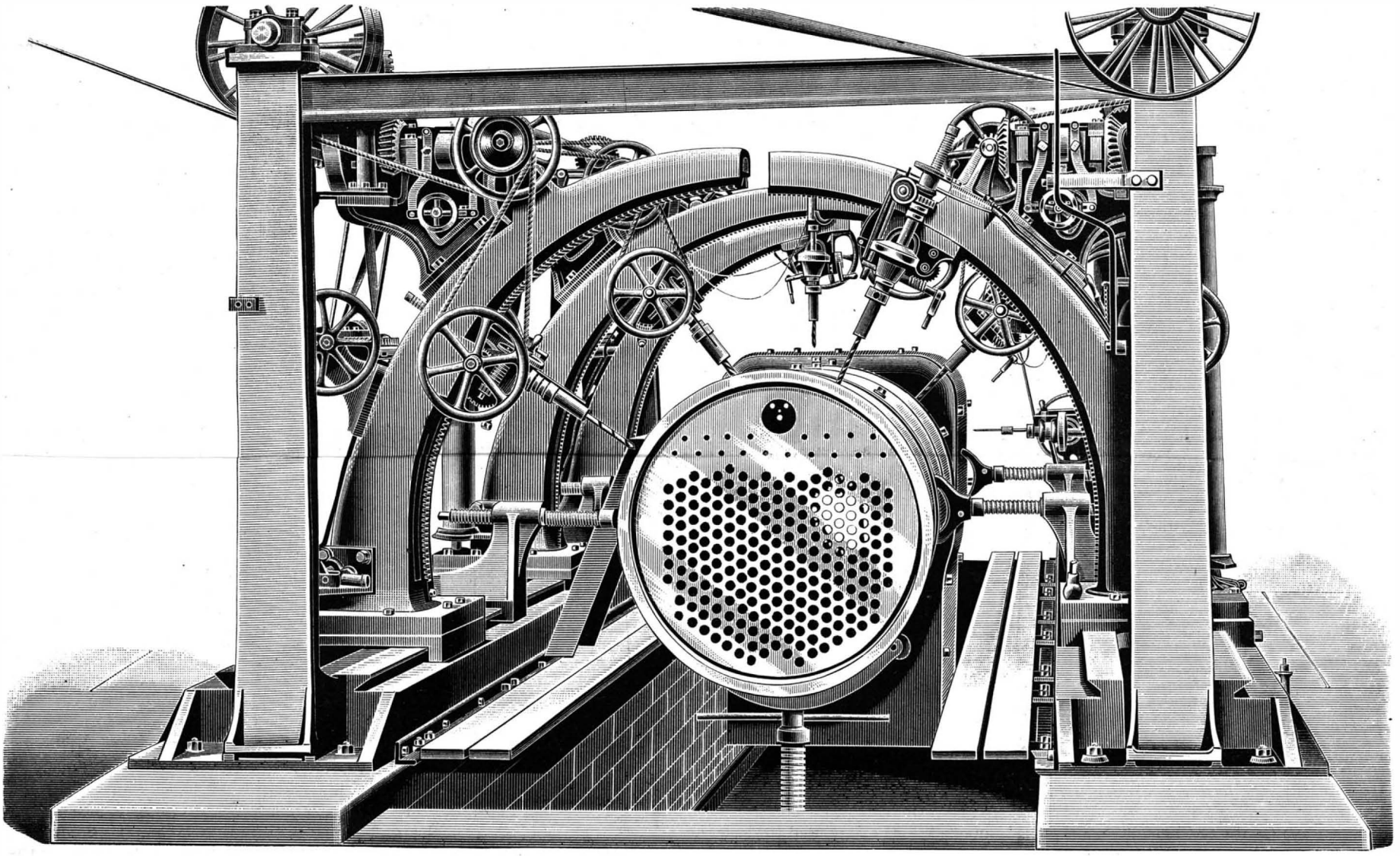
IMPROVED DRILLING MACHINE FOR BOILERS.

To insure satisfactory results in the manufacture of steam boilers for high working pressure it is generally stipulated that all holes in the plates shall be drilled, and not punched or reamered, and that the bent or curved portions of the boiler shall be drilled after being bent. The holes in the flat portions of the boiler are readily dealt with in vertical or horizontal drilling machines with single or multiple spindles, but the curved portions, such as the barrel and flanged corners of the fire box shell of a locomotive boiler, require special treatment, and the machine which is illustrated below has therefore been devised.

It will be seen that the boiler shell, after being completely built and tacked together with a few service bolts, is placed horizontally in the machine, and there held by suitable screw apparatus. The upper half is then operated upon by the several drills; and afterward the boiler is moved half way round, and the holes in the remaining portion drilled, thus completing the work with only one shift of the job. It is obvious that this method of drilling insures absolute coincidence of the rivet holes, a matter the importance of which needs no comment; and, although several machines have been devised for the simultaneous action of several drills upon one and the same job, we do not know of any one which—to the same extent as the machine illustrated—combines this qualification with such completely independent and universal action of the drill spindles.



IMPROVED DRILLING MACHINE FOR BOILERS.

The *Engineer*, London, to which we are indebted for our illustration and the particulars here given, says the machine has been designed and patented by Mr. C. M. Davies, M.I.M.E., and recently constructed by Messrs. Hulse & Co., Ordsal Works, Manchester, for Messrs. Dubs & Co., of the Glasgow Locomotive Works—where it is now in full operation. It has two horizontal slide beds, placed respectively on opposite sides of a pit, with vertical standards carrying the self-contained countershafting attached to the ends of each.

In the beds are racks by means of which the several drilling headstocks may be traversed by hand and power in either direction for quickly adjusting the drills in lines parallel with the axis of the boiler. Fitted to the beds are sliding saddles with circular tee slides on their upper surfaces, affording radial adjustment to the drill spindles in horizontal lines. Segmental arms surmount the saddles, and are fitted with spindle slides adjustable radially thereon by curved racks. The spindles are thus made to point always to the axis of boiler when drilling the horizontal and circular seams of the barrel, but there is yet another adjustment provided for each spindle, namely, a vertical radial adjustment, enabling it to drill holes in various planes parallel to each other, as in rectangular fire boxes, or at angles with each other, as in curved fire boxes. Rotary motion is transmitted from the countershaft to the drill spindles by means of endless leather bands and bevel gearing, tension apparatus being fitted to each drilling headstock for always keeping the band tight, and friction clutches for applying and suspending the rotation of each spindle independently. An independent self-acting feed motion by screw and differential gear is provided for each spindle, and a quick hand traverse in and out. The machine illustrated has six drill spindles, but this number may be varied according to requirements.

Abuse of the Stomach.

Different constitutions have peculiarities in regard to the way in which they assimilate food, and the old adage that what is one man's meat is another's poison is a very true one, says the *Popular Science Monthly*. There is no ailment more common in middle life and in old age than indigestion. This, of course, depends upon improper food taken too frequently and in undue quantity. As a rule, the victim of indigestion flies to medicines for relief, or to one of the thousand-and-one quack remedies that are advertised to cure everything. How much more rational would it be to alter the diet and to give the stomach the food for which it is craving? If the stomach could talk, I can imagine it, after pills and gin and bitters and quack remedies of every description have been poured into it, begging to be relieved of such horrors and saying, "Give me a little rest and a cup of beef tea and a biscuit, and go and take a little fresh air and exercise yourself." Instead of this, the miserable organ has to be dosed with all sorts of horrible concoctions in the way of drugs, brandies and sodas, and champagne, to endeavor to stimulate it to action. There is no doubt that the stomach that requires stimulants and potions to enable it to act efficiently can hardly be said to be in a healthy state, or can long continue to do its work properly. The digestive organs, unfortunately, are the first to sympathize with any mental worry. They are like a barometer, and indicate the errors of malnutrition and its consequences. The healthy action of every organ depends on the proper assimilation of the food taken. As soon as the digestive process fails everything fails, and ill health results, with all its disastrous concomitants.

American Institute of Homeopathy.

The homeopathic doctors of America held a jubilee meeting at Denver, Col., commencing June 14. In the evening Governor Waite and Mayor Van Horn welcomed the members. Governor Waite said:

"It is my pleasant duty, as governor of the State, to welcome you to Colorado. There is a peculiar propriety that the governor of such a State as this should extend to you cordial greetings, because Colorado is one grand sanitarium and offers life to invalids, to whom health is restored by nature. The bulk of our people are free from inherited prejudices against the different medical schools. But we can well appreciate the system of medicine which does not make the human system a storehouse for bad-smelling drugs and takes the least of its own medicine. We can also appreciate the medical association which was the first to accord to women all the advantages of men in giving diplomas. You give to woman her rights as to education and the practice of medicine. We give her the rights of citizenship, and have no taxation without representation. Go thou, learned doctors, to your homes and do likewise. Colorado offers pure air and magnificent scenery. We have rock-walled, dark canons and lofty, snow-capped mountains. Our springs offer medicine for many complaints, and are as varied as the odors from ambrosial nectar to all the combined smells of famous Cologne. Our railroads will carry you from the deepest canons to the top of Pike's Peak—nearer heaven, perhaps, than some of you will ever reach by any other means. Colorado is all before you. You may choose your place to rest, with Providence as your guide."—*The Hahnemannian Monthly.*

Blood Clotting Explained.

Recently, before the Physiological Society, Berlin, Dr. Lilienfeld gave an account of his researches on the clotting of blood. He had succeded in separating Al. Schmidt's fibrinogen into two substances, "thrombosin" and an albumose. The former unites with calcium and forms fibrin, while the albumose retards clotting. The separation of fibrinogen into these two constituents may be brought about by means of acetic acid, nuclein, nucleic acid, and other substances. Blood clotting, accordingly, consists in a disintegration of leucocytes, setting free nuclein; the latter then decomposes the fibrinogen, and enables the thrombosin to unite with the calcium salts of the blood. While the blood is circulating in the body it contains no free nuclein in solution, and hence clotting is impossible. The speaker further considered that peptones (albumose) and leech extract prevent clotting by themselves uniting with the calcium of the blood, and thus preventing its union with thrombosin.

A FRENCHMAN, M. Bersier, has devised a plan by which the compass performs the part of the helmsman. An electric current is placed to work on the desired course, and when the vessel gets off the course for which the electrical instrument is set, the current starts a motor in either direction and moves the rudder until the vessel returns to her proper course. A two months' trial of the apparatus is reported to have resulted very successfully. Among the advantages of this new method is greater accuracy and no loss of distance in a run of twenty-four hours, as is usually allowed for ordinary steering by hand.

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How the Chinese Make India Ink.

After many unsuccessful efforts to worm the secret of the manufacture of India ink out of the Chinese, science is finally to have the last say upon this product of the Celestial Empire.

Gunpowder, porcelain, crackle-china, green indigo, and, in fact, all the very ancient Chinese products have been unveiled to us by science only; and it is science again that is to teach us how the Chinese manufacture their celebrated ink. The following is a brief *resume* of the interesting researches, crowned with success, that Mr. Dagron has made upon this subject.

It has always been thought up to the present that the Chinese manufacture their ink by grinding a special lampblack, unknown to Europeans, with a suitable mucilage discovered by them, and that the paste obtained is allowed to dry slowly like their porcelain. The light that has just been thrown upon this subject is due to the progress that has been made in micrographic studies in recent years. In fact, upon submitting a very dilute solution of the most celebrated India ink to an examination by a very powerful microscope, it has been discovered that the particles of carbon forming the basis of the ink are of a uniform diameter. Upon repeating such examination with inferior or counterfeit India inks, it is observed that the particles of carbon are of very variable and sometimes even disproportionate diameters.

Upon submitting to such control all the numerous varieties of lampblacks, it is found that none possesses this regularity of the atoms. The blacks that most closely approach it are those that have been comminuted during the manufacture and the lightest portions selected. Nevertheless, the diameters of these are still more irregular than in India ink.

This first point established, a second remained to be fixed. Is the mucilage employed by the Chinese simple or compound? Thanks to the principle established by Mr. C. Kœcklin, and mentioned by Mr. Schutzemberger in his *Traité des Matieres Colorantes*, we know that two mucilages of opposite nature reciprocally thin one another upon being mixed, and in proceeding by elimination, after analysis, we find that the compound mucilage employed by the Chinese unites in itself about the extremest thinness of the Kœcklin principle.

An India ink having been prepared according to these data, in a state of solution, and left at rest for one or more months and then decanted, it was observed that the particles of carbon more and more closely resembled those of the genuine India ink. Upon afterward allowing this liquid ink to concentrate and evaporate in a vacuum, there is finally obtained a plastic substance which, when dried, has all the characters of the best India ink. It was of interest, from a theoretical standpoint, to ascertain this latter fact; but, in ordinary practice, it seems to be much simpler and more rational to leave the ink in a liquid state than to form it into a stick, that it would be necessary later on to redissolve with some trouble.

This liquid ink has the same properties as the best quality of India ink in sticks, and serves for the same purposes, such as making drawings and washes.—*Le Genie Civil.*

The Treatment of Hiccough with Snuff.

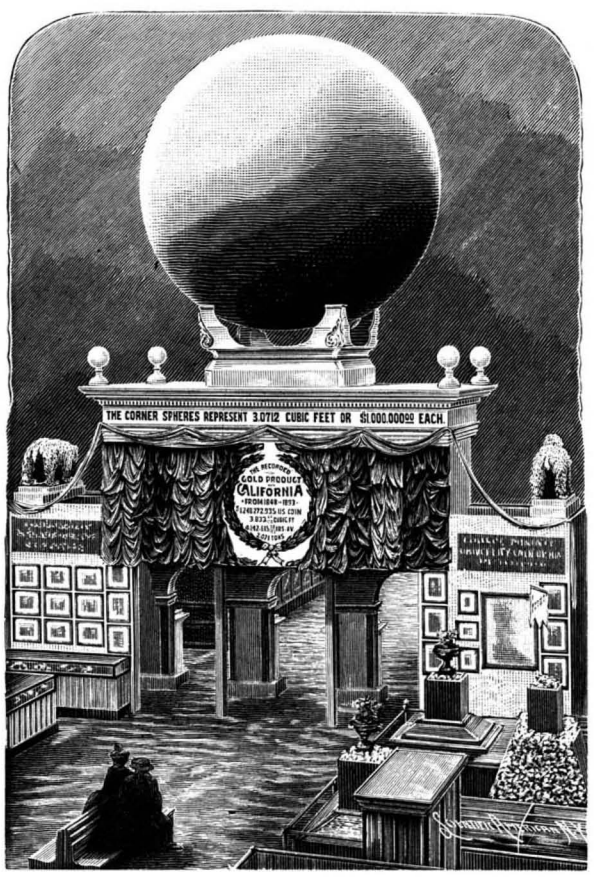
In the *Journal des Praticiens* for May 5 (*Lyon Medical* for May 20), M. Tatevossow relates a case in which he successfully combated diaphragmatic spasm, accompanied by cough or prolonged paroxysms, by making the patient take snuff until sneezing set in. Its action was immediate, the paroxysm ceased, and the continued use of the snuff caused the disease to disappear. This, it is remarked, is an extenuating circumstance in favor of snuff that the societies against the abuse of tobacco might take into account in their proceedings. —*N. Y. Med. Jour.*

An Effervescent Purgative Lemonade.

The *Journal des Praticiens* gives the following formula, by Dr. Constantin Paul, who recommends it on account of its rapid action (in two or three hours) and its being tolerated: Sodium phosphate, 375 grains; distilled water, 8 ounces; sirup, 1 ounce; tincture of lemon, 25 drops; citric acid and sodium bicarbonate, each, ½ drachm.

NOTES ON THE MIDWINTER FAIR.

The Midwinter Fair, like the Columbian Exposition, has passed into history, and California may be congratulated on carrying the great enterprise to a successful termination. California made the most extensive display of any of the States at the Columbian Exposition, Illinois, perhaps, excepted. The mineral resources and the vegetable productions of California, as exhibited in the two fairs, were a revelation to the Easterner.



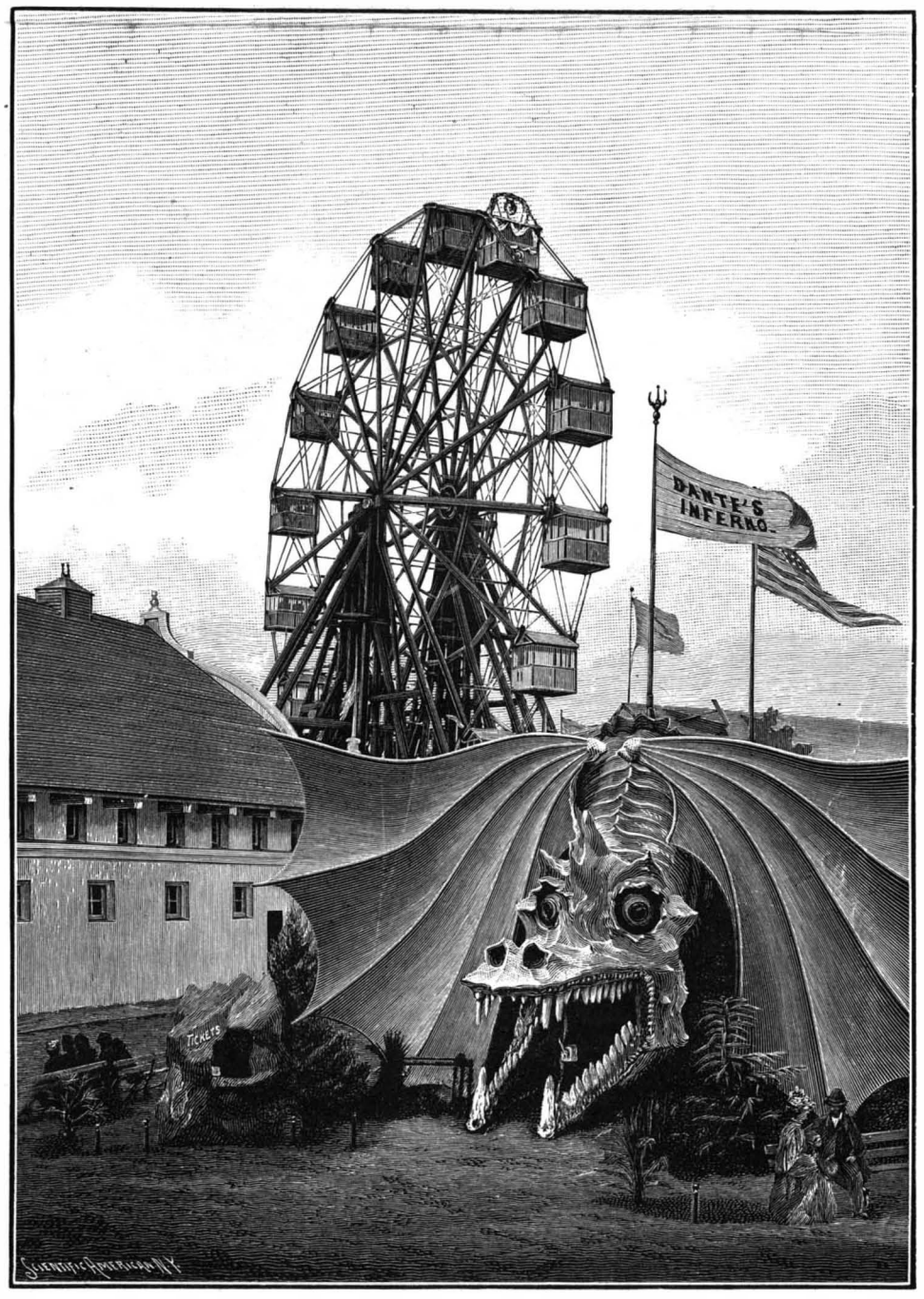
GILDED BALL SHOWING GOLD PRODUCT OF CALIFORNIA.

A conspicuous object in the Mechanical Arts building of the Midwinter Fair was a huge gilded ball, which is shown in our illustration, made from photographs taken by Mr. A. W. Cornwall. This large globe, which surmounts the pavilion of the College of Mining of the University of California, was intended as one of those great object lessons which appeal to the eye and are remembered long after the dry statistics have been forgotten. The ball showed the total recorded gold product of California from 1848 to 1893, representing $1,248,272,935 in United States coin, a weight of 2,071 tons, and a bulk of 3,833 cubic feet.

The small globes at the corners represented 3 0712 cubic feet of the precious metal, value $1,000,000. This is not the only globe representing the amount of gold mined, for Nevada County exhibited a ball which showed the total gold product of the county as $205,000,000.

After looking at the ball for a few minutes, the visitor gained some knowledge of where the present wealth of California sprang, and was doubtless glad to reach the open air, where there was less chance to indulge in day dreams on the potentiality of riches. The Firth wheel at the Midwinter Fair afforded a magnificent bird's eye view of the entire coast, including San Francisco Bay, the Golden Gate, the Pacific, and the ranges of wooded hills surrounding Concert Valley. At its foot a dazzling panorama was spread out. Owing to the elevation of the grounds, the highest line of vision is 305 feet above the Pacific. The wheel is 100 feet in diameter, which added to the height of the platform and the site carried visitors about 150 feet over the average level of the grounds. The total weight of the wheel and its sixteen cars was 192,000 pounds. The steel shaft weighed 18,000 pounds. The total capacity of the cars was 160 passengers. The towers which supported the wheel weighed 800,000 pounds. The method of propulsion was entirely different from that employed in the Ferris wheel, a cable system being employed in place of cogs. The wheel was driven by a reversing engine of 200 horse power. About twenty minutes were occupied by the trip. At night the wheel was brilliantly illuminated with incandescent lights.

Near the wheel is seen the huge dragon whose fiery eyes and yawning mouth were a terror of little folks. A huge hollow rock at the left formed a ticket office. A touter or "barker" dressed in the costume of Mephistopheles called attention to the wonders and horrors of Dante's Inferno.



FIRTH WHEEL AND THE DRAGON AT THE MIDWINTER FAIR.

Fire Caused by Electric Lamps.

Fire occurred in the business portion of Victoria, B. C., on the 5th ult. Fortunately the loss was only $15,000, and the records would show the origin "unknown," but for experiments made after the fire was extinguished. In the upper story of a dry goods house, several thirty-two candle power incandescent lights were installed. One of the lights was connected with a long insulated wire, and several feet of spare wire allowed the moving of the light from one portion of the room to another. Through ignorance or carelessness, the globe was laid on a pile of goods. The fire occurred shortly after the light was turned on at the power house, which goes to prove that the globe was placed on the goods during the day. The tests were made in the room where the fire originated, and were reported in the *Victoria Times* as follows: "There is no longer the slightest doubt as to how the fire started, as two tests have shown that the incandescent light will ignite cloth. Last evening, in the presence of Mr. Hutcheson, Chief Deasy, representatives of the *Times*, and a few others, a child's woolen hood was tied around the 32-candle light, the latter having been turned for ten minutes previously. Steam came from the wool almost immediately, and then smoke. At the end of eight minutes the hood was on fire and the globe burst. A similar test was made the evening before, and the cloth ignited in six minutes. Wool is the least inflammable of fabrics, and the test last evening was as severe as could be desired. All danger in this connection can very easily be avoided, either by hanging the globes free from anything that will take fire or by placing guards around them."—*Fire and Water.*

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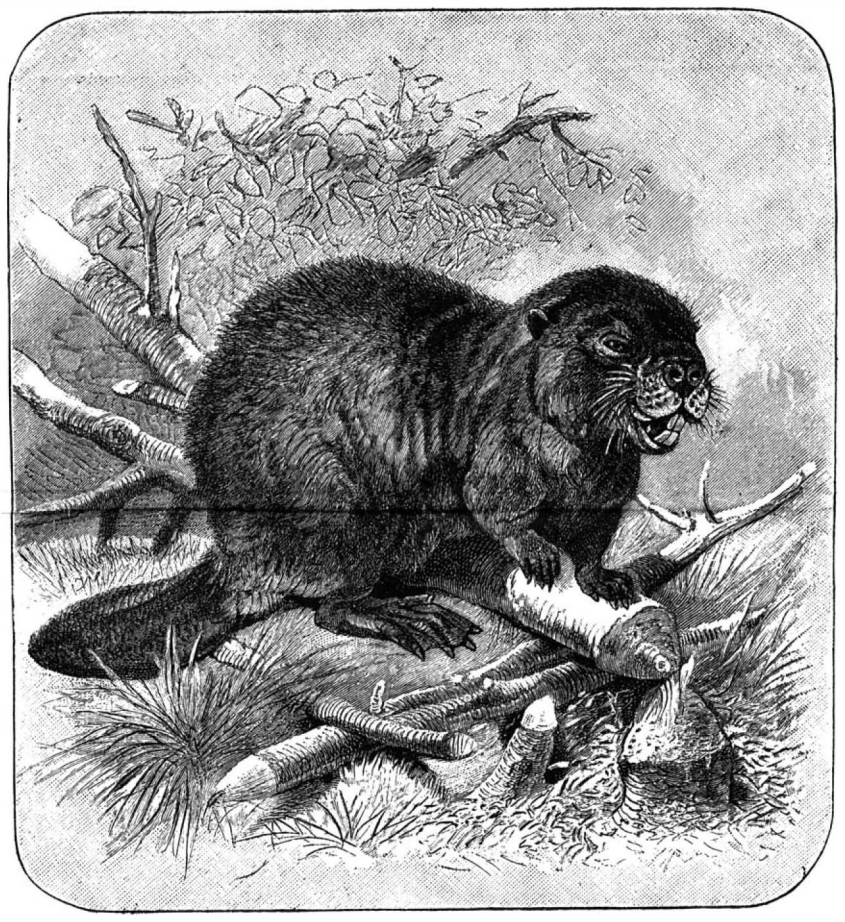
THE LIFE AND HABITS OF THE BEAVER.

Our engraving shows a rare animal, or rather one that has become rare. While it was formerly widespread and numerous in the temperate and even the colder parts of Europe and Asia, and also of America, it has disappeared quickly wherever it came in contact with human beings, and although so familiar an object years ago, there are now comparatively few people in Europe, especially in Germany, who have had an opportunity of seeing a beaver in its natural state. The land was too highly cultivated, for the rodent requires lonely, uncultivated regions for his home, and he was hunted because he made havoc among the young trees and for the sake of his fur, his meat, which many like, and for the perfume secreted by certain glands of his body, so that beavers, like many other animals, have been decimated.

The beaver is one of the most important rodents. As the body of a full grown male is about 2 feet 7 inches long and weighs about 60 pounds, there are few rodents that surpass him in size; in Europe he has no equal among the rodents. The broad head, somewhat narrowed toward the front, on a short, thick neck, and the stout body, which is wider at the rear, give the animal a clumsy look. The webbed hind feet indicate its amphibious nature, and his tail is of such a peculiar shape that any child could recognize him by it; it is flattened, so that when one looks down upon it, it seems to be egg-shaped, and it is covered with little angular scales. The color of the tail is dark gray, while the thick fur on the animal's back is chestnut brown and that under the body is lighter.

The beaver's chief tools are his very large chisel-shaped teeth, which are very long and prominent. His nose and ears are well adapted for his aquatic life, for the little short ears that are nearly hidden in the fur can be laid so flat on his head as to effectively exclude all water, and in a similar manner the nostrils are closed by thick flaps. For years past busy fancy has added many fables and fairy stories to the accounts of the beaver's life and habits, but these are sufficiently interesting without such additions, especially where he can enjoy undisturbed security.

We must go to lonely parts of Asia or North America, particularly to Canada—the latter has the beaver in its coat of arms—to find large colonies or societies of beavers, for they settle on rivers and streams that run through forests in which the sound of the ax has never been heard, building in their characteristic fashion. Their dome-shaped houses or "lodges," which are sometimes nine feet high, serve as temporary dwellings to be used in case the underground dwellings are flooded. The latter are entered by long tunnels that open in deep water. The neighboring wood furnishes the materials for the "lodges;" even thick trees fall victims of the sharp teeth of the beaver, and are skillfully cut up. The branches and twigs, the bark of which forms his food, are all used for building, being placed one upon the other without regularity; but the beaver, a natural marine architect, saves the thicker stems for a different purpose. If the level of the water in the stream on which he has settled is subject to marked variations, he builds a dam reaching from one bank to the other, these dams often being 650 feet long and several yards thick at the base. The thick logs are driven into the ground and bound together by thinner branches, and then the whole is covered with earth, mud and water plants, forming a scientifically built dam. When a large colony has settled in a safe place in the wilderness regular cities grow up, and the appearance of the landscape is entirely changed by the thinning of the woods and the formation of extensive ponds by the dams, for generation after generation works on, increasing the size of the settlement until the beaver cities in the lonely wood can compete for age with the cities of men. In our thickly populated Germany we look in vain for large colonies of beavers, for they are entirely extinct in most parts of the empire, and where individuals are found they do not build lodges, but content themselves with underground dwellings like those of the otter; only a few districts can now boast of possessing beaver lodges, but a few years ago a colony of thirty individuals was discovered not far from Schonebeck, on the Elbe. Strict game laws have procured a home for him here, and here opportunity is still offered to observe him living under natural conditions. For ages there were colonies of beavers on certain parts of the Elbe and on the Danube, but in the course of time he has become a stranger in his own land.—*Illustrirte Zeitung.*



THE BEAVER.

THERE are 1,785 separate railroad companies in the United States.

Costs of Manufacturing.

The movement which is being made in Congress to reduce the tariff on cotton and woolen goods is of great interest to the people who have their money invested in those industries. They have made great efforts to have their rights protected to such an extent that they can manufacture goods for home consumption and successfully compete with the foreign manufacturer who is so eager to obtain admittance to our markets. It is probably an established fact that, whatever tariff bill is passed by Congress, the duties on cotton and woolen goods that are imported will be lower than under the McKinley bill. With these facts staring us in the face, there seems to be but one course for American manufacturers to pursue, and that is to reduce the cost of manufacturing their goods. Can this be done to any extent, or to such an extent that, should the tariff bill now under discussion become a law, our mills can be operated at a profit? This is a serious question and one deserving much thought.

A close observation in several of our leading mills, both cotton and woolen, within the last three weeks, shows us that few, if any, of them have reached the point where a reduction in the cost of their goods cannot be made. If this is a fact, the question then comes, How can this be done? Let us refer to a few ways in which, in our opinion, quite a reduction in the cost of labor in our mills can be made; first, there are many mills which are using very poor machinery—machinery that has been in use from twenty to thirty-five years. It is of light build, can only be operated at a slow speed, and is of the kind that requires more hands to look after it, even to obtain a small product, than the improved machinery of the present time would require to obtain an increase of 25 or 30 per cent, occupying the same floor space in the mill, and not taking much, if any, more power to operate it. In fact, many of our mills are full of machinery that should long ago have been consigned to the scrap heap and new put in its place.

Another fact is, many, in fact most, of our mills have more help than is required to take care of their machinery. Employes should have work enough put upon them to keep them busy. Not working all the time on the keen jump, but enough so that by keeping busy they can easily perform their task. To bring this change about requires good management on the part of overseers. They should be ever present in their rooms, unless having special business in some other portion of the mill or yard. This being the case, they should attend to that duty as soon as possible and return to their rooms. Their continual presence among their help, even if there is nothing for them to do, is worth a great deal—a fact that every agent and superintendent should impress upon their minds and insist on its being enforced. Our mills are workshops. The employes are there for a business purpose. Every one of them is supposed to and should have sufficient work put upon them to require their full attention and best efforts to perform it during working hours. Overseers should watch carefully and ever be on the alert to check all visiting of their help from one room to another, which is done to such a large extent in mills at the present time. When the overseer is in his room, or department which may contain one or more rooms, he should not spend his entire time perched on a high stool at his desk, but should be circulating about, watching his machines, seeing that no bad work is being made, and if the machinery is in good order to perform its work; not trusting too much to his second hands, but looking himself, to quite an extent, after his section men, ever studying the interests of the company or individual that employs him, and ascertaining if there is not some place where he can better his work, and at the same time reduce the cost of manufacturing in his department. Overseers, as a rule, are a well-paid class of men, and they should look after their departments as closely as if they were in business for themselves and every dollar of capital invested was their own.

Another point we would mention, and this we have carefully studied and know we are right in the assertion, that the waste in our mills is not looked after to the extent that it should be. A tour among the cotton and woolen mills in the old country plainly shows us that in the working of the waste made in our mills we are greatly behind the English. It is surprising to see the marked difference between American and European manufacturers in that one thing alone. We do not place value enough upon the waste made in our mills. Visit any manufacturing point, and you will find waste dealers carting away from our mills enormous quantities of waste for which they pay a very small price. This waste is worth to the very manufacturer who is selling it, if properly utilized, nearly double what the waste dealer pays for it.

Another point we would mention, and a very important one it is, too, and that is the excessive cost of power in most of our mills where steam is used. This comes from two sources: First, the boilers, grates, and steam appliances are such that from one-third to one-half more coal is burned than should be to produce the power that is used. In many cases firemen are not carefully enough instructed about keeping their fires; a great deal of coal is wasted needlessly through the carelessness and ignorance of the firemen, even when the steam appliances are in fair condition. The second thing is the enormous amount of friction in the main lines of shafting in many mills. The shafting is not kept leveled up as it should be; therefore, instead of there being perhaps 15 or 20 per cent of power used to overcome this, 30 and 35 per cent is used in many cases, and when you waste it you waste money.

It is a fact, although we dislike to admit it, our cotton and woolen mills, as regards machinery and the improved methods of manufacturing at a low cost, in discipline, etc., are very much behind those in England. We will allow that many machines are in use there that we do not hear of, and perhaps for the class of goods we are now making we do not need them, but on a common run of work we are very much behind the English manufacturers. The disclipine of our mills does not begin to equal theirs. This is a needless neglect, and can easily be remedied. Many of the places where we are weak in our mills can be strengthened at little or no cost. A close observation also shows that many of our mills have more overseers than is really needed. A doubling up can be done at profit in many cases by paying the second hands a little more, and securing better ones. The points we have mentioned are only written after having carefully studied this matter through personal observation, both in this country and in England, and our manufacturers will find we are right in every assertion, if they will take pains to investigate them fairly. It is our opinion that we can produce cotton and woolen goods in this country at a much less cost than is being done at the present time, and we believe our manufacturers will support us in this statement.—*Boston Journal of Commerce.*

The Columbian Exposition Medal.

For the reverse side of the medal, a design of Charles E. Barber, of the Philadelphia Mint, has been accepted, that of St. Gaudens for the obverse being retained. The original design for the reverse was rejected because of its nude figures, in place of which the accepted design contains a shield with the following inscription: "World's Columbian Exposition. In Commemoration of the Four Hundredth Anniversary of the Landing of Columbus, MDCCCXCII, MDCCCXCIII," and a place for the name of the recipient of the medal. The shield is surmounted by the globe, at either side of which are female figures representing Fame. It is said that it will require three months to finish the engraving, on account of this delay in obtaining designs acceptable to the authorities.

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Natural History Notes.

The Stability of Characters in Mushrooms.—Cultivators have long known that there exists a large number of varieties of the common mushroom, and that their characters are so clearly defined that certain experts claim to be able to recognize their mushrooms in the midst of the hundreds of baskets that daily reach the market. In fact, they distinguish such varieties by the color, by the presence or absence of scales, by certain circular blotches of the color of wine lees, by the reddish color to the touch, etc.; but what is the botanical value of these varieties? Within what limits are they permanent? That is something that no one can at present say. No gardener can, in fact, cultivate a given variety indefinitely, since, at the end of three successive cultures, on an average, the vitality of the spawn diminishes, and it would be to expose himself to serious losses to desire to preserve a given mushroom too long. Experts well know, on the contrary, that during the successive cultures made with a certain spawn the mushroom gathered always preserves a large number of constant characters, since, in their cultural processes, they merely divide the spawn. The ordinary experience of cultivators, therefore, in nowise proves the fixedness of the varieties of the ordinary mushroom, but merely establishes the point that if the spawn perpetuates itself, it is always the same crop that is gathered. But is the stability of the characters that define a variety as great when, instead of dividing the spawn, we reproduce the fungus by spores? Such is the problem that Messrs. Constantin and Matruchot have endeavored to elucidate.

The results of the experiments that they have undertaken to this effect have shown that the characters of varieties are kept up with remarkable fixedness. The cultivators who furnished the specimens submitted to these experiments did not hesitate to recognize their products as identical with those that had served as a starting point. Hence it follows that the color of the pileus, its scaly or fibrillose aspect, and the presence of a more or less persistent veil are hereditary characters of a stability that has hitherto been unsuspected. Along with these constant characters, there are others that are variable, for example, the size and consistency of the fungus and the relative dimensions of the stipe and pileus. But it should be known that such variations are likewise observed in culture through division of the spawn.

In short, there results from these experiments the important fact that in the future it will be possible to apply the process of selection to the cultivated varieties, and particularly to bring the selection to bear upon the varieties with a white pileus, which cultivators usually prefer. There is even reason to believe that such successive selections will gradually render the products obtained more perfect, just as has been the case with a large number of cultivated phanerogams.

A Great Botanical Work.—The first part of the "Index Kewensis" is now in the hands of botanists. Since the publication of the second edition of Stendel's "Nomenclator Botanicus," in 1840–1, there has been no other attempt to collect and publish the names of the thousands of plants described in the botanical literature of all nations. The "Index Kewensis" is what its title implies, as it gives references to the place of publication of each genus and each species. The foundation of this work, upon which Mr. B. Daydon Jackson and several assistants have been engaged ever since January, 1882, may be claimed for the late Sir William Hooker, who, in a brief preface, gives the following history of the publication:

"Shortly before his death, Mr. Darwin informed me of his intention to devote a considerable sum in aid or furtherance of some work of utility to biological science; and to provide for its completion, should this not be accomplished during his lifetime. He further informed me that the difficulties he had experienced in accurately designating the many plants which he had studied, and ascertaining their native countries, had suggested to him the compilation of an index to the names and authorities of all known flowering plants and their countries, as a work of supreme importance to students of systematic and geographical botany, and to horticulturists, and as a fitting object of the fulfillment of his intentions.

"I have only to add that, at his request, I undertook to direct and supervise such a work; and that it is being carried out at the herbarium of the Royal Gardens, Kew, with the aid of the staff of that establishment."

Sir Joseph Hooker himself has devoted an immense amount of time to the herculean and monotonous task of revision, and has brought his vast personal knowledge to bear on the independent but by no means inconsiderable task of settling the geographical distribution. Mr. Daydon Jackson estimates that the complete work will contain about 400,000 names and many more references; and the first part contains nearly 110,000 names. The period covered is from the establishment of binominal nomenclature by Linnæus down to the end of 1885. If nothing occurs to hinder the present rate of progress, the whole work will be issued by the middle of 1895.

The Insects of Primary Times.—Insects existed as long ago as the Silurian epoch. In the Carboniferous period they were numerous in species belonging to at least four orders, the Neuroptera, Orthoptera, Homoptera, and Thysanoura. Many of them were of extremely large size, and some exceeded in dimensions the largest animals of this group that live in the present time. Some, in fact, had a spread of wings of nearly 28 inches!

Although, in its general feature, their organization was the same as that of the insects that exist around us, it exhibits characters of a great importance in certain types, for these shed considerable light upon certain obscure points of the morphology of these animals and mark the successive stages that the insect type has passed through before reaching its final form. In the first place, the thorax is divided into three segments, instead of forming a single mass, as is generally seen. The first thoracic segment of the present insects carries the first pair of legs, but is always deprived of wings. These organs of flight are inserted upon the meso and metathorax. Some of the insects of the Carboniferous age exhibit this arrangement, but there are others in which the number of wings corresponds to that of the legs, and in which a pair of wings occupies the first thoracic segment. These arthropods are, therefore, hexapterous as they are hexapodous. These first wings, which are smaller than the others, resemble the rudimentary elytra of the mesothorax of the phasmids. It is probable that when we shall come to know the insects that have preceded those of the coal period we shall find that the dimensions of the prothoracic wings were almost equal to those which come after, or else that the three pairs of wings were small and equal to each other. These alar appendages of the prothorax have disappeared in the insects of our time. Besides, several of these ancient insects have preserved in the adult state characters that are found in our day only in the nymphs or in the larvæ.

If we examine the fossil insects from the view-point of the relations that they offer with the present fauna, we see that they differ *in toto* from the living types, not only specifically and generically, but even to such a point that they cannot enter the families created for the types that exist at present. It has, therefore, been necessary to form new groups to take a place in the natural orders. The Neuroptera are largely represented, and offer a great variety of forms. The order of Orthoptera is represented by cockroaches, phasmids, locusts, and crickets; that is to say by about the same groups that still live. Yet we observe quite notable secondary differences between these ancient insects and their present representatives, and which reside mainly in the arrangement of the wings.

Another character of the highest interest is met with in the Blattariæ (cockroach family). The species of our epoch lay their eggs inclosed in ovigerous capsules, others are oviparous. The Palæblattidæ, on the contrary, were provided with an ovipositor and laid their eggs one by one, as do our Phasmidæ and Locustariæ. The present Phasmidæ have the wings of the first pair reduced to the state of scales; the coal Protophasmidæ had the four wings well developed.

The Homoptera were represented in primary times by types whose wing nervation recalls that of the Fulgoridæ, but while the latter have very short antennæ, these organs in the Protofulgoridæ were highly developed.

Finally, some species possessed elongated buccal pieces, and this permits us to believe that these insects sucked the juices of vegetables with these instruments.

A study of the primary fossil insects corroborates the data furnished by plants relative to the climatology of the Carboniferous epoch, and proves that the atmosphere was then humid and warm, and that the light was undoubtedly intense.

The Guests of the Florida Gopher.—The Florida gopher (*Gopherus polyphemus*) is a tortoise that attains a length of 10 or 12 inches and weighs 8 or 10 pounds. It excavates galleries 18 or 20 feet in length in sandy ridges remote from water, which descend in a straight course at an angle of 35°, terminating abruptly at a depth of 8 or 9 feet beneath the surface. It is a reptile of ancient lineage, whose burrowing habits were probably established in ages zoologically remote. Like its European relative, it is a long-lived animal, and its habitation, once completed, is maintained and occupied for a long series of years. Such an ancient and well established domicile, with entrance always open, naturally serves as a place of refuge for many animals when hard pressed by enemies or to night prowlers when daylight overtakes them far from their proper homes. Even the rattlesnake is said to have more than a passing acquaintance with those cool retreats. Among the permanent guests of this reptile is what is popularly called the gopher toad, an animal which is really a frog, and of the habits of which nothing is known. Mr. Henry G. Hubbard, wishing to know something more of the gopher and its associates, was led to undertake the laborous task of excavating and thoroughly examining one of the burrows. The result of his examination was the discovery of thirteen species of insects, ten of them new to science and one representing a new genus. A few of them were characterized by the lack of color and the distinctly subterranean appearance that mark a true cave insect and dweller in darkness. The differentiation of the various forms from their allies above ground had not proceeded so far as to produce profound modifications of structure, yet the variation that had been caused by this half cave life was quite pronounced. It was shown in many of the species, not only by a loss of color, but by a more glabrous surface of the body and a greater slenderness of form than is found in related species. The new species found by Mr. Hubbard are described (some of them with figures) in the May number of *Insect Life*.

That a gallery in the sand of so diminutive proportions as a gopher's burrow can harbor so large a number of hitherto undiscovered insects, and afford an environment potent to effect such changes in the structure and life of animals, might well seem incredible were it not for the very unique conditions which here exist. The temperature of the burrows varies but five degrees throughout the year, the extreme in winter being 74° F. and in summer 79° F.

An Electrical Dinner.

The City of London Electric Lighting Company, Limited, gave lately a large banquet at the Cannon Street Hotel, for the purpose of demonstrating the feasibility and convenience of cooking by electricity. *Engineering* says: Before the dinner commenced the guests were invited to see the apparatus at work, and had the opportunity of inspecting the joints, poultry, fish, vegetables, etc., frying and simmering in the electric ovens and saucepans. A temporary kitchen had been set up close to the dining room; this was, of course, perfectly easy to do, as there were no flues to provide for the escape of the products of combustion of coal and gas. The influence of the near proximity of the cooking apparatus was felt in the hot state of the viands. Instead of having to travel a long distance from a kitchen, either underground or on the highest story of the building, arriving half cold, as is too often the case at public dinners, they were brought direct from an adjoining apartment, and were served before they had commenced to cool. The cooking was in every way excellent, and left nothing to be desired; as, indeed, it should be when the heat is under absolute control, and there are no products of combustion to mingle with the delicate flavor of the comestibles. At the close of the dinner the lord mayor—an authority every one will respect—declared that it had been in every way satisfactory. The chairman, Sir David Salomons, explained that there were 120 guests, and 60 units of electricity, costing exactly £1, had been used in cooking the dinner. This works out to 2*d*. per head, or 0·2*d*. per course, a truly insignificant amount. While the company charge 8*d*. per unit for current used for lighting, they charge only 4*d*. for that employed for cooking and motive power. Dr. Silvanus Thompson, in reply to the toast of "Success to the Development of Electricity," recalled a former electric dinner given in 1749 by Benjamin Franklin on the banks of the Schuylkill. The turkey was killed by an electric shock, and cooked by a fire kindled by an electric spark, while various electric experiments seem to have served as entrees in an intellectual entertainment which preceded the dinner. Dr. Thompson's wonderful knowledge of early scientific history renders his speeches, on such occasions as these, most interesting.

Watering Garden Plants.

Watering garden plants, as commonly practiced, is an absolute injury to vegetation, for the reason that it is not done plentifully enough. When the earth is dry and hot, the application of a little water only increases the heat and has a tendency to make the soil more compressed and drier than before. The most of our soils are more or less calcareous, and the action of the sun's heat has the same effect as heat upon limestone. The carbonic acid is expelled, and when brought in contact with moisture heat is generated, and unless sufficient water is applied to overcome the heat, vegetation suffers. A sprinkling pot should never be used in time of drought, unless the soil around the roots of the plants is at the same time thoroughly soaked, and the watering should always take place after sunset, when the dew has begun to fall.

This is in accordance with natural laws. Rain and sunshine seldom appear together, and, further, when nature waters vegetation the atmosphere is filled with moisture. Pool water and soapsuds are good for the garden, and cistern water may be used, but should be exposed to the sun and air through the day before applying. Strong liquid from the barnyard is death to garden plants and should only be used after diluting until very weak. My plan of watering to avoid making a hard surface crust around the plants, says a writer, is to dig three or four holes on the different sides of the hill a few inches away, and into these pour not less than one pailful of water, and after all has soaked in replace the dry earth, and then with watering pot sprinkle the dry earth.—*Farmers' Voice.*

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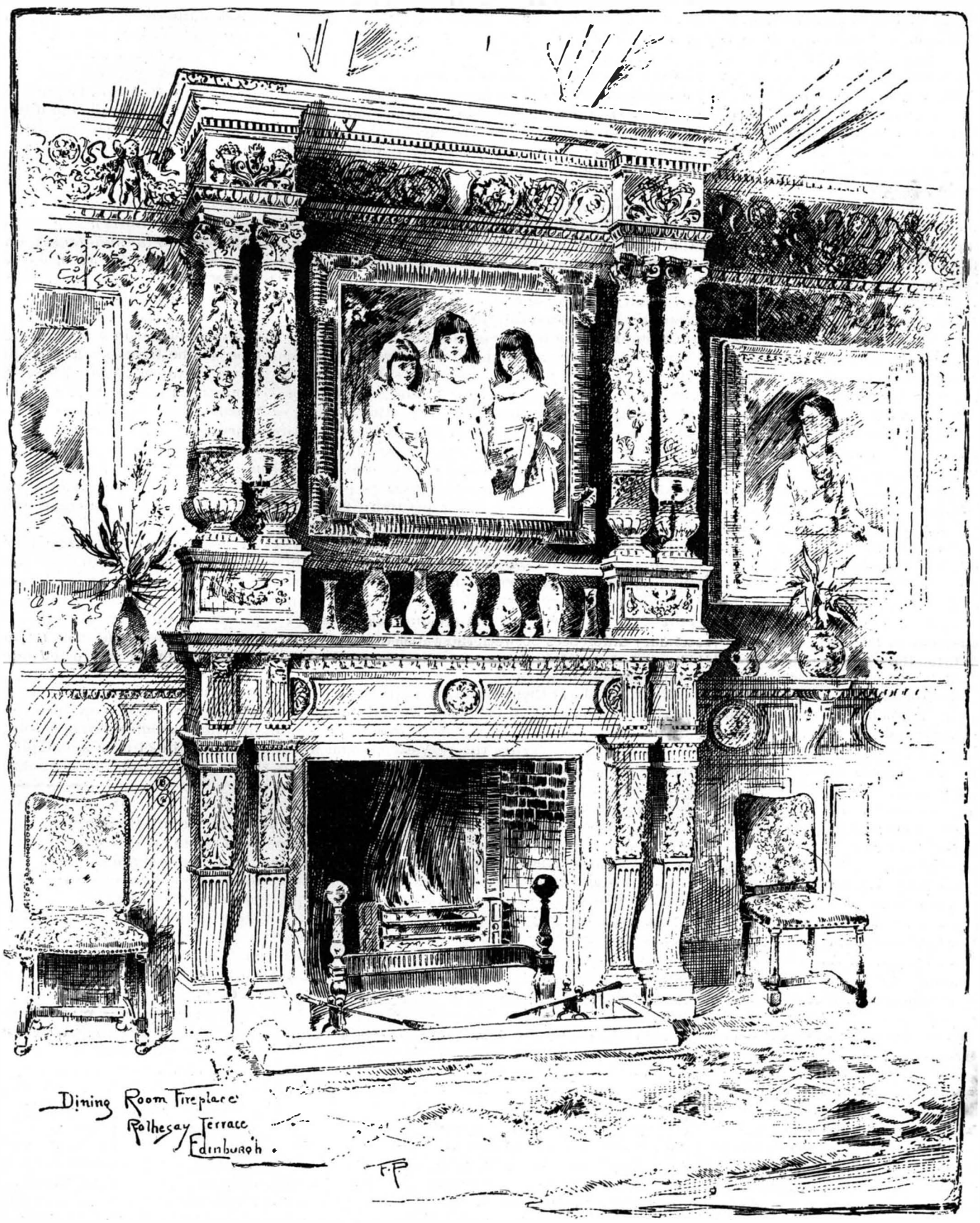
A BEAUTIFUL FIREPLACE.

The accompanying illustration of a dining-room fireplace is taken from a celebrated Scotch residence located in Edinburgh. The engraving first appeared in the *Furnisher and Decorator* and subsequently in the Architects and Builders Edition of the SCIENTIFIC AMERICAN. It is a tasteful and harmonious design; a good example of the class of large fireplaces now in vogue.



A DINING-ROOM FIREPLACE IN A SCOTCH RESIDENCE.

The Railways of the United States.

The Inter-State Commerce Commission has lately made its sixth statistical report.

The total mileage of railways in the United States on June 30, 1893, was 176,461·07, being an increase during the year of 4,897·55 miles. The corresponding increase during the previous year was 3,160·78, from which it appears that there was some revival in railway construction during the year covered by the report. The number of roads abandoned during the year was nineteen. The total length of line, including all tracks, was 230,137·27, which includes 10,051·36 miles of second track and 42,043·40 miles of yard track and sidings.

The total number of locomotives on June 30, 1893 was 34,788, being an increase of 1,652 during the year. Of these, 8,957 were passenger locomotives, 18,599 freight locomotives, and 4,802 switching locomotives, the remainder being unclassified. The total number of cars owned by the carriers making report was 1,119,878, to which should be added 154,068 leased cars, making a total of 1,273,946 cars operated directly by the carriers. This shows an increase in the number of cars directly controlled of 58,854 during the year. Of the total number of cars, 31,384 were in the passenger service and 1,047,577 in the freight service. The number of passengers carried per passenger locomotive was 66,268, and the number of passenger miles per passenger locomotive was 1,588,601. These figures show an increase in the efficiency of passenger locomotives. The number of tons of freight carried per freight locomotive was 40,062, and the number of ton miles accomplished per freight locomotive was 5,031,889. These figures show no change in the efficiency of freight locomotives as compared with previous years.

The total number of employes in the service of railways on June 30, 1893, was 873,602, being an increase of 52,187. Of this total of employes, 35,384 are assigned to the work of general administration, 256,212 to maintenance of way and structures, 175,464 to maintenance of equipment, and 397,915 to conducting transportation, the remainder, 8,627, being unclassified.

The aggregate of property properly classified as railway capital was on June 30, 1893, $10,506,235,410, which shows railway capital equal to $63,421 per mile of line. The amount of stock outstanding was $4,668,935,418, of which $3,982,009,602 was common stock, the remainder, $686,925,816, being preferred stock. The funded debt outstanding was $5,225,689,821, classified as follows: Mortgage bonds, $4,504,383,162; miscellaneous obligations, $410,474,647; income bonds, $248,132,730; and equipment trust obligations, $62,699,282. The amount of investment in the railway securities has increased during the year from $1,391,457,053 to $1,563,022,233, being an increase of $171,565,180.

The amount of stock paying no dividends during the year was $2,859,334,572, being 61·24 per cent of the total stock outstanding.

The total dividends paid was $100,929,885. The amount of mortgage bonds paying no interest was $492,276,999, or 10·93 per cent of the total of mortgage bonds, and the amount of income bonds paying no interest was $204,864,269, or 82·56 per cent of the total of income bonds.

The total number of passengers carried during the year ending June 30, 1893, was 593,560,612.

The number of tons of freight reported by the railways for the year was 745,119,482. Ton mileage was 93,588,111,833.

The gross earnings from operations on the railways of the United States for the year ending June 30, 1893, was $1,220,751,874, being an increase of $49,344,531 over gross earnings reported in the previous year. Operating expenses during the year were $827,921,299, being an increase of $46,923,303 over the previous year.

The final net income available for dividends was $111,058,034, being a sum less than the corresponding amount for the previous year of $4,907,157. After deducting from this amount the dividends paid, the income account of railways in the United States for the year 1893 shows a surplus of $8,116,745, which is less than the surplus of the previous year by $5,919,311.

The number of railway employes killed during the year was 2,727, being greater by 173 than those killed during the previous year. The number of employes injured was 31,729, being greater by 3,462 than the number injured the previous year. The number of passengers killed during the year was 299, being less by 77 than the number killed the previous year, and the number injured was 3,229, being two in excess of the number injured the previous year. Of the total number of deaths to employes on account of railway accidents, 433 were due to coupling and uncoupling cars, 644 to falling from trains and engines, 73 to overhead obstructions, 247 to collisions, and 153 to derailments, the remainder being due to causes not so clearly defined. An assignment of casualties to the opportunity offered for accidents shows one employe to have been killed for every 320 men employed, and one to have been injured for every 28 men employed. The most dangerous service is that of trainmen, and for these the statistics show one employe to have been killed for every 115 trainmen, and one employe to have been injured for every 10 engaged in this service. A similar comparison shows one passenger to have been killed for each 1,985,153 passengers carried, or for each 47,588,966 passenger miles accomplished, and one passenger injured for each 183,822 passengers carried, or for each 4,406,659 passenger miles accomplished.

Wood Pulp Pipes.

Wood pulp is agitated with water and rolled on a tube. After the pulp is wound to a sufficient thickness around the tube, and the extra amount of water drains away, it is placed on end and the interior mould is withdrawn, leaving the wood pulp tube, which is held on suitable supports and dried until the water is evaporated. The further process consists of dipping it into a very hot solution of asphaltum and other materials, which penetrate the whole substance. The ends are then squared up, and the threads cut, or taper finish is made in the usual manner of wrought iron pipe.

This material, when finished, possesses high electrical resistance, rendering it suitable for underground conduits for electric wires. As a non-conductor it is free from being impaired by electrolytic action from earth return currents, which have become such a serious factor in impairing the water and gas pipes in cities where the street tramcars are propelled by electric motors using earth return circuits. Its resistance to acids and alkalies fits it for use in chemical works. As a non-absorbent of water it is free from any difficulties due to expansion and contraction. The bursting strength of the tube is said to be from 150 pounds to 250 pounds per square inch, according to the size. It can stand a temperature of 150 degrees.

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Notes on Science and Industry.

Composition of Amethysts and Turquoises.—That the structure of some minerals often presents a certain indeterminateness is well known. Mr. A. Carnot, whose researches upon the presence of fluorine in fossil bones will be recalled, having devoted himself to the study of the chemical composition of amethysts and turquoises, has ascertained that all amethysts contain fluorine. As for turquoises, there is reason to make a distinction between those of Oriental and western origin. The former are true minerals and contain no trace of fluorine; as for the latter, they contain fluorine in the same proportions as the bones of the tertiary epoch. This conclusion is a confirmation of the hypothesis emitted as to the origin of such turquoises, that is, that they are nothing more, in fact, than the product of the fossilization of the teeth of animals.

Analysis of Steel.—One of the great difficulties met with in the analysis of iron and steel is due to the enormous excess of oxide of iron amid which it is necessary to operate, and which, when it is obtained in a gelatinous state by humid way, carries along all or a portion of the other elements and often completely masks the presence of them. Mr. H. K. Bamber, at the recent meeting of the Iron and Steel Institute, recommended a method that has given him excellent results, and surmounts the above mentioned difficulty. He attacks 13 grammes of the metal with nitric acid; saturates incompletely with pure carbonate of soda, and then evaporates to dryness. The oxide of iron resulting from the decomposition of the nitrate remains in a pulverulent state, all the other bodies remaining in combination with the soda. He places the product in distilled water containing a small quantity of carbonate in solution and passes the whole through a double filter, which retains the oxide of iron. All the other elements are contained in the soda solution, which is analyzed by the ordinary methods.

Mr. Bamber claims that he has thus detected in the majority of steels small quantities of chromium, arsenic, and molybdenum, the presence of which was unsuspected.

The Browning of Oakwood.—According to the *Moniteur Industriel*, the dark oak employed in decorative woodwork is prepared by submitting the wood to the action of ammoniacal vapors, which rapidly give the dark tint that is in so much request. The method consists simply in arranging the material to be rendered of a dark color in a tight room into which no light penetrates. For small pieces, a large box whose joints are closed with strips of paper glued to the places whence the vapor might escape fully suffices. For larger pieces there should be a hermetically closed room. Into the box or room are put several flat glass vessels containing liquid ammonia, and placed upon the floor so that the vapor may fill the space and give the tannin of the oak a very dark brown color, which will not be altered if a little of the wood be removed from the surface. The liquid should not touch the wood, and the depth of the color will depend upon the quality of the ammonia employed and the length of time of the exposure to its fumes.

Concentration of Sulphuric Acid by Electricity.—The industrial concentration of sulphuric acid presents certain difficulties that are due to the fact that only platinum, glass or porcelain vessels can be employed. The use of platinum has prevailed in practice by reason of the fragility of glass and porcelain apparatus, but the employment of it is costly, although the researches of Messrs. Faure and Kessler have reduced to a minimum the quantity of this metal brought into play. Moreover, it is found that the sulphuric acid always dissolves a small quantity of the metal, so that the apparatus have but a limited duration.

The *Electrician* announces that Mr. Bertram Blount, in order to obviate this inconvenience, proposes to heat the acid to be concentrated by means of a platinum conductor entering the liquid and traversed by an electric current sufficient to raise its temperature to 150° above that of the acid. The latter may therefore be placed in non-metallic vessels, which are no longer subject to breakage, since they do not transmit heat. In order to be concentrated from 60° to 66° B., 117 kilogrammes of acid require 32,679 heat units, say 44·2 horse hour. It results from these figures that electric concentration requires an output of fuel five times greater than direct condensation; but by reason of the advantages enumerated above, it is possible that the final cost of the operation may, notwithstanding, be less than by direct heating, especially in the case of a motive power produced by waterfalls.

Mr. Blount recommends the use of a platinum wire 5 millimeters in diameter and 77 centimeters in length heated to 480° C. by a 364 ampere current. Such a wire would be able to concentrate 24 kilogrammes of acid in five hours. The maximum difference of potential would be 5 volts. It seems insufficient to cause a sensible loss of platinum through electrolysis, and any such loss might be completely eliminated by the use of alternating currents.

Preservation of Fruit with Lime.—More or less attention has been paid for some time past to the subject of the preservation of fruits and roots by means of powdered quicklime. An interesting communication, says *Le Genie Civil*, has recently been made by Mr. Monclar to the Agricultural Society of Albi on the subject of the results of his experiments in this direction. He exhibited in support of his assertions some chasselas grapes which were perfectly preserved, and which were as round and plump as they were on the day that they were gathered. The taste also was the same, except perhaps that it was a little more saccharine. Unfortunately, despite the fact that they had been washed, some traces of lime remained upon a few of the berries. They had remained embedded in the lime for seven months. Mr. Monclar stated that, after they had remained only four or five months therein, a washing caused the whole of the lime to disappear. He added that his grapes had been perfectly preserved during the entire winter for two years. About the middle of March only a tenth were spoiled, and a month later about half of them. In order to have perfect success, it would be prudent not to put off the consumption of the fruit beyond the beginning of March. Mr. Monclar also exhibited some apples that had been preserved in the same way for a long time and that were found to be in a perfect state.

Volatility of Iron.—Some experiments made by Mr. Fleitmann upon the welding of iron with nickel have brought to light some very curious facts as to the volatility of iron and its atomic penetration. In these experiments, the adhesion of the two metals was such that it became impossible to separate them by mechanical action, and a chemical examination demonstrated a true alloyage—an intimate composition, although the welding had been done at a temperature lower by 500° or 600° than the point of fusion.

Other experiments have established the volatility of iron at a cherry-red temperature. Two superposed plates of iron and nickel having been submitted to the same heat, the iron passed over to the nickel in notable quantity without there resulting either welding or adhesion of the surfaces. There formed over the entire plate of nickel an alloy with the iron which, in plates of one millimeter, penetrated to a depth of 0·05 of their thickness and contained on an average 24 per cent of this metal, the proportion being naturally greater at the surface.

An important fact to be noted is that the passage of the iron to the nickel is not reciprocated. While the combination is shown at the surface of the nickel plate by the silvery luster of an iron alloy of 50 per cent of nickel, the iron plate remains intact and preserves the dead appearance that it received from scouring. This penetration of the iron can also be ascertained by the scales.

The volatility of the iron in this particular case still awaits an explanation. It is not known whether it must be attributed to traces of ferric cyanide, chloride or carbide. At all events, the very exceptional weldableness that it shows, as compared with other metals, must depend upon a volatilization partial to a temperature much lower than the point of fusion.

The Natural Varnish of Japan.—The famous varnish so extensively employed by the Japanese for lacquering various articles of furniture and small ware is obtained from a tree known to science as *Rhus vernicifera.* This varnish tree, which is called *urushi-naki* by the Japanese, grows to a height of about thirty feet, and, at the age of forty years, its trunk is forty inches in diameter. It reaches its greatest perfection at its eighteenth year, and then produces its largest yield of lac or varnish. This is obtained by making incisions in the bark in a horizontal direction, an operation that may be performed at any time between April and October. Later in the year the lac is very thick and viscid, so that the collecting of it is attended with much greater difficulty. The lac tapper carries his own peculiar bow-shaped knife, made for this purpose, with which he cuts a 2 millimeter gash in the trunk of the tree and then draws the point of the knife through the cut again in order to remove any chips formed by the first incision. This cut is made low down. On the opposite side of the trunk, a little further up, he makes a second cut, and then on this side again, and so on, until he has made from six to ten such incisions. After he has operated thus upon about a dozen trees, the tapper returns to the first tree and collects the fluid that has oozed from the cuts, and which, at first milky white and thick, becomes, through exposure to the air, first dark brown and finally quite black. This crude lac is called *ki-urushi.* The tree is hacked in this way for from sixty to eighty days, until it dies. It is then cut down, and the wood chopped up and put into hot water, which extracts the last remnant of the liquid, amounting to not more than half a pint. This forms the poorest quality of lac. The lac is purified by filtering it through cotton stuff, grinding on a paint slab, mixing with water, and then evaporating the latter by heat. The finer sorts are bleached in shallow dishes in the sun. The best kind is called *nashyi-urushi*, the poorer kind *henki-urushi*, and the unbleached *jeshime-urushi.* The black varnish, *roiro-urushi*, is made from the crude lac. There are about twenty different kinds in the market, of which the above named are the most used. The operation of varnishing is conducted in a very different manner from what it is with us. The Japanese apply their varnish mostly to woodwork; less frequently to copper and unglazed stoneware and porcelain. When applied directly to tinware, the lacquer does not stick. When applied, the varnishes are generally brilliant black, dark colored, impure vermilion, or impure dark green or dark gray. Pure light colors and white cannot be produced with Japan varnish. The Japanese varnishers prepare their woodwork with the utmost care. The surfaces are smoothed and the chinks filled in with cement. The ground coat is a mixture of the unbleached lac with paste, upon which is laid Japanese paper rubbed smooth with a brush and dried. Afterward, several very thin coats of the same varnish are applied, and each coat, after being well dried, is polished with Japanese carbon. The drying is done in a moist atmosphere, the apparatus used being a tight box whose sides are wet with water. After twenty-four hours one coat is dried, and if the article is to be black, a coat of black varnish (*roiro-urushi*) is applied, but if it is to be gray or gray brown, *jeshime-urushi* is used instead, and if it is to be red, the latter varnish is mixed with vermilion. The appearances of gold and pearl are obtained by mixing real gold dust, or mother-of-pearl dust, with the varnish, whereby a beautiful effect is produced. The article is then dried, rubbed down and polished; and if there are gold, tortoise shell or mother-of-pearl decorations, a coat of azure varnish (*nashyi-urushi*) is applied. In applying their varnishes, the Japanese use broad brushes, the bristles of which are very stiff and inserted in wood, just as the graphite is in our lead pencils. After long use, the bristles get worn short, and the wood is then cut away just as in sharpening a pencil, thus exposing more of the bristles. A very fine piece of work receives eighteen coats. These never fade with time, but rather improve, bear a high temperature, and are totally unaffected by acids, spirits, and the like. The Japanese method is not likely to be introduced into Europe or this country, because of the want of the natural material, which when imported becomes extremely costly, and because the process is indirect and tedious, and, with the high price of labor, would be impracticable.

Antique Bronzing.—The repeated applications to copper or brass of alternate washes of dilute acetic acid and exposure to the fumes of ammonia will give a very antique looking bronze; but a quick method of producing a similar appearance is often desirable. To this effect the articles may be immersed in a solution of one part of perchloride of iron in two parts of water. The tone assumed darkens with the length of the immersion. On another hand, the articles may be boiled in a strong solution of nitrate of copper; or, lastly, they may be immersed in a solution of two ounces of hyposulphite of soda in one pint of water. Washing, drying, and burnishing complete the process.

Mirror Experiments.

Some interesting experiments with a rectangular glass prism are described, says *Nature*, by W. C. Rontgen in *Wiedemann's Annalen.* Those who have tried looking at themselves as reflected by two mirrors, placed at right angles to each other, will remember the amusing effect created by the image, contrary to the usual reflection in a mirror, not being reversed right and left. We can see ourselves "as others see us," also, by looking straight at the surface subtending the right angle of a rectangular prism. Herr Rontgen observes that in no case is the pupil divided into two equal parts by the faintly visible edge of the prism. This is an illustration of the angle between the line of vision and the axis of the eye, which is different in different people. Rectangular prisms can be easily tested for correctness of the angle by observing whether the two images of the cross wires in a telescope, as seen in the two surfaces, coincide. The same test would tell us whether two mirrors are exactly at right angles—a fact which might be usefully applied for testing instruments like Gauss' heliotrope. Such a pair of mirrors, or a rectangular glass prism, give rise to another peculiar phenomenon. If they are rotated about the axis of vision, the image rotates in the same direction with twice the speed. If, therefore, the object, say a cardboard disk with writing on it, rotates twice as quickly as the mirrors or prism, it will appear to stand still. This might be applied to investigate the effects produced upon bodies by rapid rotation. Another peculiarity is that such an instrument will reflect rays falling upon the hypotenuse at any angle up to 45° to the same spot. By rotating such a prism about a line at right angles to its edge and to its hypotenuse the author was enabled to reflect the light from an electric lamp through a distance of 1 km. with ease and certainty.

Sulphonal in the Treatment of Whooping Cough.

The June number of the *Practitioner* contains the following prescription: Sulphonal, one grain; creosote, two minims; sirup of tolu, water, each, two ounces. Two teaspoonfuls of this mixture are to be given every two hours.—*N. Y. Med. Jour.*

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RECENTLY PATENTED INVENTIONS.

Engineering.

CONDENSER.—Cary S. Cox, Spottiswood, Cal. To quickly condense the exhaust steam and prevent back pressure in the engine, this condenser comprises a shell through which air circulates, there being within the shell a drum having a steam inlet pipe and a water outlet pipe, a series of tubes connecting the heads of the drum with each other, each tube lined on its inner surface with a water-evaporating fabric, while a water sprinkler is arranged within the shell above the upper head of the drum. The construction is simple and durable.

Railway Appliances.

REFRIGERATOR CAR.—Ferdinand E. Canda, New York City. This invention provides for a novel combination of central and outer braces with insulating linings secured to them, adapted to form three independent air-tight chambers, whereby a maximum carrying capacity with a minimum of dead weight is obtained, the insulated condition being maintained for an indefinite period, so that fresh meats, fruits, and other perishable articles may be safely transported for long distances with an economical consumption of ice.

SWITCH.—Henrey H. Matt, Long Island City, N. Y. This is an improvement in switches adapted to be operated from a moving car. A switch point is pivoted on a bed plate beneath which is a chamber where a horizontally tilting lever is fulcrumed and connected at one end with the switch point, a guide plate with parallel grooves and with a rail section being arranged adjacent to the switch point, while a lever fulcrumed in the guide plate projects into the grooves, a connecting rod extending from the lever to the lever of the switch point.

SWITCH OPERATING DEVICE.—William F. Dermody, Brooklyn, N. Y. This is a device to be operated from a car in motion, the invention also providing means for automatically resetting the switch point after a car has passed. A shifting arm is attached to the pivot of the switch point, there being a locking bar normally in engagement with the arm and counterbalance weights connected with opposite sides of the bar, while a shifting bar adapted to be operated by a passing car is connected with the locking bar between the weights. There is a lever at the opposite side of the switch point to the shifting lever of the locking bar, the second lever being connected with the shifting arm of the switch point.

TROLLEY STAND.—Eleazer F. A. Heastings, Avalon, Pa. This is an improvement in devices mounted on the cars of electric railways to support the trolley pole, and comprises a flat-topped base on which a bracket is journaled to turn horizontally, and with arms between which is pivoted a second bracket carrying the trolley pole, bow springs clamped to the lower bracket having their upper ends pivoted to opposite ends of the second bracket. The device presses the trolley wheel firmly against the wire, but is so flexible that the wheel easily follows the wire through its different elevations.

CAR FENDER.—Marguerite Maidhof and Victor F. Maidhof, New York City. This improvement comprises a scoop-like fender consisting of a platform and a back, pivotally connected with each other and covered by a solid top or suitable netting. Near the front end of the platform portion of the fender are wheels or rollers traveling on the track rails, and the fender is pivotally suspended from the car by a pivot extending centrally from its vertical back portion through a pivot plate on the under side of the car. The head of the pivot is pressed on by a spring to permit of an up and down movement with the jolting of the car.

SAFETY GUARD FOR CARS.—Joseph W. Betz, Brooklyn, N. Y. A fender frame is, according to this invention, hinged by its rear end upon the car below the car body, there being rollers on the lower side of the frame, a spring-pressed latch slidable from the platform, and a retractile spring engaging the car and fender frame. When not needed for service the front end of the fender is held up from the track, under the car body, but it may be instantly released to drop into position to catch a person struck by the car, inclining forwardly and downwardly.

Mechanical.

TIRE BOLT WRENCH.—Joseph E. Campbell, Fairfax Station, Va. This tool consists of a pair of pivoted jaws, one of the jaws carrying two swiveling wrench heads connected by gears and the other jaw slotted and having at opposite ends bearings for a turning crank, while a sliding frame with a clutch screw is arranged to be adjusted in line with either wrench head, and a detachable turning crank has its end adapted to pass through either of the bearings and be seated in one of the wrench heads. It is a simple and practical tool for quickly and conveniently removing the nuts and bolts which fasten the tires to the fellies of vehicle wheels, even when they become rusted together.

MAKING METALLIC BODIES.—Hartley C. Wolle, Bethlehem, Pa. This inventor has devised means for making pipes, cylinders, etc., in such way as to avoid welding flaws and render the mass very homogeneous. It comprises the use of a horizontal revoluble mould through which extends an adjustable mandrel, while a receptacle is adapted to receive the surplus molten metal from the mould. The metal rotates with the mould, while the axis of the mandrel is stationary, the metal being subjected to compression as the mould rotates.

Miscellaneous.

JOINT FOR ELECTRIC WIRES.—James H. Curry, Wilkinsburg, Pa. This is an automatic safety joint consisting of a box or support having two insulated anchorage pins, and two arms connected with the pins by a loose slotted connection with supporting seats for sustaining the arms when under tension, a bridge connecting the arms, and means for holding them out of electrical contact when they fall away from the bridge. The improvement is designed to prevent accidents when live wires become broken or detached and fall in the street, the brake then automatically cutting off the current from the ends of the wire. The joint may also be used as a substitute for the bell-shaped supports now used on overhead electric lines.

WHEEL FOR BICYCLES.—George W. Smiley and Forest W. Dunlap, London, England. This wheel has a pneumatic cushion between its hub and rim, and the tire is connected with the cushion by thrust spokes movable radially independently of the wheel rim, but guided by the wheel rim, so that while the wheel will be laterally and radially stiff, the elastic cushion, by which resiliency of tread is obtained, is transferred from the external tire to a point intermediate of the rim and hub, where it is not exposed to injury.

COFFEE DRYING APPARATUS.—Richard P. Hocking, Mayaguez, Porto Rico. For drying coffee after the red shell has been removed from the berry, this inventor has devised a simple and inexpensive apparatus whereby the berry may be subjected to constantly recurring currents of heated air, the air then finding ready exit from the apparatus, but this exit being under complete control. As the drying chamber or cylinder is revolved the berries are constantly changing position, every portion of their surface being presented to the drying agent.

ICE CREEPER.—James R. Russell, Hopewell Hill, Canada. A flat metallic plate bent in U form to encircle the edge of the heel has two forward and a central rear calk, the plate being attached to a moccasin or shoe heel by screws. When the creeper is not needed, a block of leather, wood or other material, is formed with recesses for engagement with the calks, this block being held in place by a clamping bar to cover up the calks and form a heel with smooth bottom.

GATE.—Emil Neuhauser, Gridley, Ill. This inventor has made an improvement in gates to be raised or lowered by levers at opposite sides, the opening and closing mechanism being adjustable to balance a long or a short, a heavy or a light gate, and the operating mechanism making it impossible for the gate to remain on a center. When the lever is operated to open the gate the latch is disengaged from its keeper, the gate being automatically latched on closing. The construction is simple and inexpensive, and the mechanism is not likely to be interfered with by rain, snow or ice.

DOOR CHECK.—Jacob Suter, New York City. This device consists of two rigid, pivotally connected arms, one pivoted to the door jamb and the other adapted for detachable pivotal connection with the door. From the latter arm a bar is projected adjacent to the door, and adapted to form a brace for the arm, there being means for locking the bar to the door. It is a simple device for locking the door partly open for ventilation, etc., or for locking it closed.

EXTENSION TABLE.—Joseph Bohr, Westphalia, Mich. This table when closed is very compact, but it may be easily opened or extended, and its construction is designed to be very simple and inexpensive. The supporting frame has recesses in its upper edge, and a leaf is adapted to slide beneath the table top, while there are supporting arms secured to the leaf and projections on the arms which lie upon the top of the supporting frame.

CIGAR PIERCER.—John W. Miller, Dayton, Ohio. This is a little machine for cutting lengthwise slits in cigar tips, instead of cutting off their ends, to facilitate smoking. It has a depending slotted socket, with depressible top, in which the cigar end is placed, when the depression of the socket actuates a pair of blades to push them into the socket and into the tip on each side, the parts returning to normal position as the cigar is removed.

FISHING APPARATUS.—Peter S. and Alfred J. Downie, Marinette, Wis. This is an improvement in apparatus for what is known as pound fishing, extremely strong wire nets being used, so arranged that they may fold one upon another, and be dropped to the bottom to escape drifting, winds, etc. The sections of the nets are connected with each other and with the supporting stakes in such manner that they are freely suspended. Before winter sets in the stakes are cut off beneath the ice line, and are spliced when spring opens.

GRAVE SIGNAL.—Hubert Deveau, New York City. This is a device to be applied to a coffin in which a person is buried, and connected with an air pipe extending to the top of the ground, where it enters a signal casing so arranged as to indicate the fact should the buried person revive and move in the coffin.

DESIGN FOR A BOTTLE.—Carlton H. Lee, Boston, Mass. The body of this bottle has in general the configuration of a human skull, and on the bottom is a representation of cross bones.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE DIATOM. By C. L. Peticolas. Richmond, Va. 24 page pamphlet. Price 10 cents.

Mr. Peticolas is well known as a microscopist and preparer of excellent slides of the Diatomaceæ. This little pamphlet contains some accounts of the Virginia and New Jersey fossil deposits, with a catalogue of about 400 slides. The articles are reprinted from various microscopical journals.

LOCOMOTIVE MECHANISM FOR ENGINEERING. By H. C. Reagan, Jr. First edition, first thousand. New York: John Wiley & Sons. 1894. Pp. x, 296. Price $2.

The author of this book, who is a locomotive engineer, has above all endeavored to make his book thoroughly practical. It is liberally illustrated and is arranged to a great extent on the following system: In the opening part of a chapter the consecutive text relating to the subject is given, and the chapter closes with a series of questions and answers. Numerous illustrations of engines are given, as well as of their parts. The work appears to be thoroughly up to date and should be very well received.

THE STEAM ENGINE AND OTHER HEAT ENGINES. By J. A. Ewing. Cambridge: At the University Press. 1894. Pp. xiv, 400. Price $3.75.

This volume is an amplification of the author's Encyclopedia Britannica article on the steam engine. In the preface he states that it was written to serve as a university text book. It represents, from the standpoint of instruction as well as from that of theory, a thoroughly advanced and up to date treatise on the subject. Air, gas, and oil engines are included in its scope, although naturally the steam engine is the principal subject.

GAS LIGHTING AND GAS FITTING. By William Paul Gerhard. New York: D. Van Nostrand Co. 1894. Pp. 190. Price 50 cents.

Mr. Gerhard, the well known sanitary engineer, has here produced a very practical little work, written largely from the common sense standpoint and one which will prove of quite extended use. It is a book which may be read with benefit by the gas fitter and the private consumer.

A STUDENT'S TEXT BOOK OF BOTANY. By Sydney H. Vines. First half. London: Swan Sonnenschein & Co. New York: Macmillan & Co. Pp. x, 430. Price $2.

This volume is the first part of a systematic treatise on botany for the use of students. It is devoted largely to morphology and the intimate structure of plants. The classification, however, occupying the second half of the work. In illustration, printing, and paper it leaves nothing to be desired, and when the second half is accessible, the student world will have at their command a most attractive treatment of the subject. The absence of an index in this volume, it is to be hoped, merely means that the complete index will appear in the second volume.

SCIENTIFIC AMERICAN BUILDING EDITION.

JULY, 1894.—(No. 105.)

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1. An elegant plate in colors showing a half stone and half frame summer cottage erected at a cost of $4,500. Perspective views and floor plans. Mr. H. Howard, architect, New York City. An attractive design.
2. Plate in colors showing a Queen Anne dwelling at Melrose, Pa., recently erected for W. H. Miller, Esq. Perspective elevation and floor plans. Cost $8,500. Mr. A. M. Walkup, architect, Philadelphia, Pa.
3. Full page engraving of Nonsuch Palace.
4. A half-timbered house at Rosemont, Pa., recently erected for John H. Converse, Esq., at a cost of $11,000. Perspective elevation and floor plans. Mr. T. P. Chandler, Jr., architect, Philadelphia, Pa. A handsome design.
5. Engravings and floor plans of a cottage at Jamaica, L. I., recently completed for B. S. Waters, Esq. A popular design of American style. Cost $5,800 complete. Messrs. Daus & Oborne, architects, Brooklyn, N. Y.
6. Residence at Yonkers, N. Y., recently erected for Cheever N. Ely, Esq. Perspective elevations and floor plans. Mr. Augustus Howe, architect, New York. A pleasing design.
7. A dwelling at Hackensack, N. J., recently erected for Mrs. Maria Bogart. Perspective elevations and floor plans. Mr. W. L. Stoddard, architect, Tenafly, N. J. A model design.
8. A colonial cottage at Hartford, Conn., erected for W. F. Goody, Esq. An attractive design. Floor plans and perspective elevations. Cost $4,750 complete. Mr. Henry D. Hooker, architect, New York City.
9. A residence at Edgewater, Ill., recently erected for G. F. Lange, Esq. Perspective elevations and floor plans. A pleasing design.
10. A residence at Bryn Mawr, Pa., recently erected for Prof. Herbert W. Smyth. Three perspective elevations and floor plans. Cost complete, $6,500. Mr. J. C. Worthington, architect, Philadelphia, Pa.
11. A picturesque country cottage at Greenwich, Conn. Perspective elevations and floor plans. Messrs. A. H. Throp & W. S. Knowles, architects, New York City. An attractive design.
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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
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Minerals sent for examination should be distinctly marked or labeled.

(6150) L. T. V. asks (1) how to find the amperage of lamps (16 candle power), 30 amperes at 110 volts being output of dynamo. A. The voltage of the dynamo fixes the voltage of the lamps as 110 volts. Then allowing 50 watts to 16 candle power, we have 50-110 or 0·45 ampere for the amperage of a lamp. Allowing for the loss in the wiring, it is safe to allow 60 lamps to the dynamo. 2. What is meant by ampere hour? A. One ampere of current flowing for one hour, or two amperes for half an hour, or half an ampere for two hours, and so on. 3. Can 110 volt lamp be used on a 50 volt circuit and 50 volt lamp on 110 volt circuit? A. No. The low potential lamps would have their filaments destroyed by the intensity of current due to so high a voltage, while high potential lamps on a low potential circuit would not become hot enough to give light.

(6151) E. F. C. writes: I have made a battery by placing a ring of electric light carbons around a rod of zinc. The carbons are all connected by a copper wire passing through them. I use sal-ammoniac solution. In a short time a bluish creeping salt forms upon the tops of the carbons and upon the wire and eats it off. The wire is above the board which holds the carbons. Will you tell me the name of this substance and how to prevent its eating the wire? A. You should have dissolved off the copper from the immersed portions of the carbon and then have coated the upper ends with paraffin applied hot. The green substance is a compound of copper, a basic oxychloride probably. It may be necessary to coat your connecting wires near the carbons also. Be careful not to destroy the contact between wires and carbon.

(6152) W. C. P.—Aluminum has but little more than one-half the strength of iron. The pressure that a cylinder will bear depends upon its thickness. Additional weight by air compression is one pound for each 13 cubic feet of free air compressed in the cylinder.

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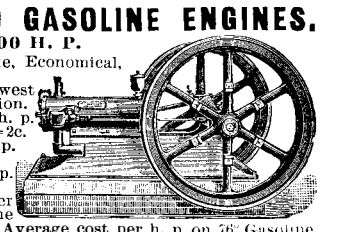
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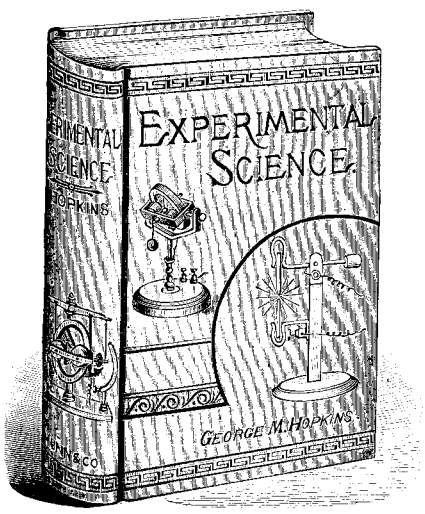

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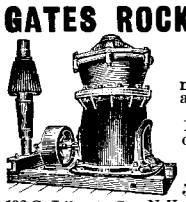

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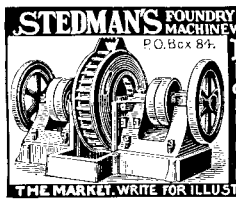

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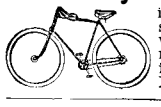

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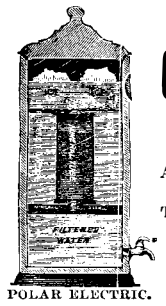

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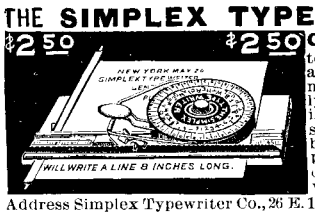

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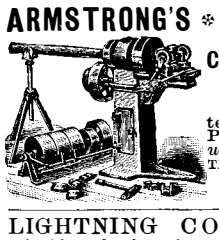

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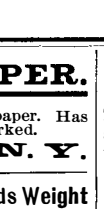

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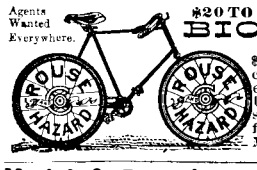

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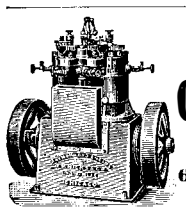

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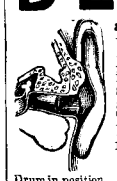

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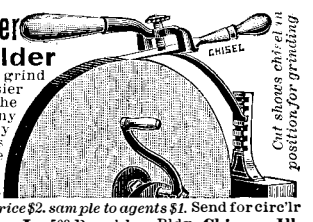

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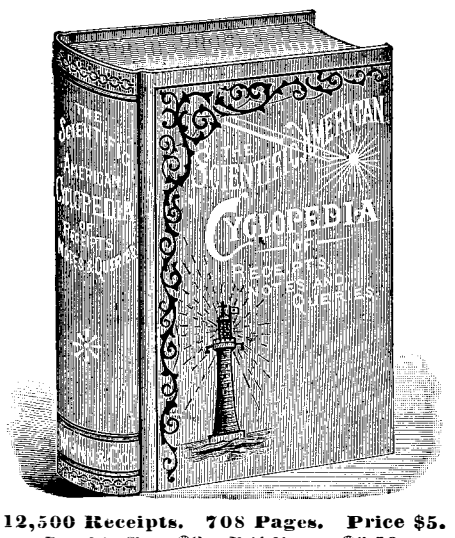

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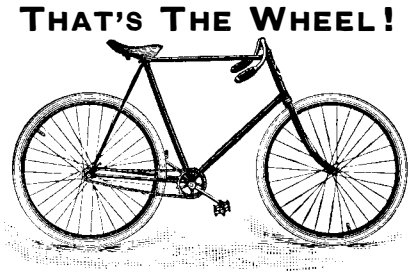

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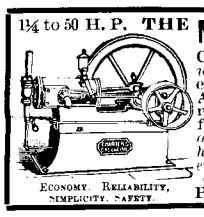

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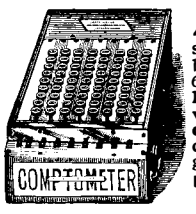

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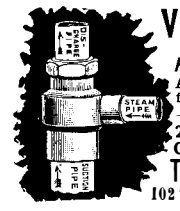

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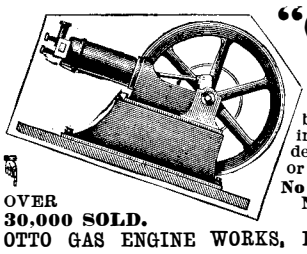

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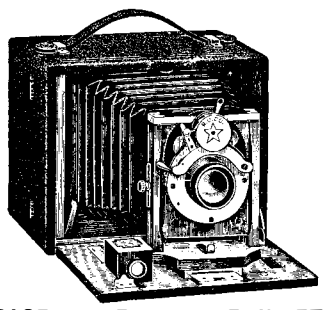

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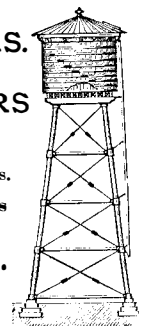

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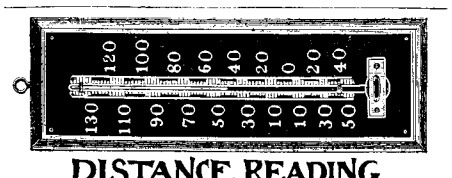

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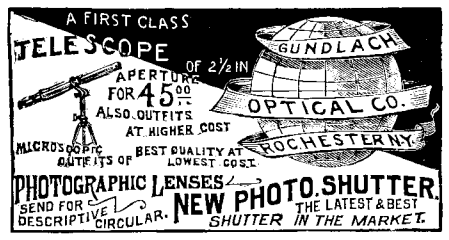

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